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JEREMIAH DIXON'S THEODOLITE.

BY the generosity of Mr. Edward Dixon of Hull the Society's collection of instruments has been enriched with the fine early Theodolite which is figured in the plate opposite. It is of value as an admirable example of the work of George Adams, an instrument-maker of the middle of the eighteenth century; but more especially in that it was the property of Jeremiah Dixon, surveyor with Mason of the Mason and Dixon line which has so large a place in the history of boundaries and boundary disputes. The instrument came into the possession of John Dixon, the nephew of Jeremiah, and has descended in the family to Mr. Edward Dixon, the grandson of John Dixon, who has now presented it to the Society. There is a strong family tradition that the instrument was actually employed in setting out the Mason and Dixon line.

In a work on surveying instruments, of which the second edition was published in 1797, George Adams the younger gives a figure and description of the "Common Theodolite"—as distinct from the "Theodolite with Telescopic Sight"—which agrees in general with our instrument—though ours has only two sights, in place of the four of the "common theodolite," and in this respect is more like the Circumferentor, which does not, however, generally have the large horizontal circle. In the centre of the horizontal plate is a large compass, and the instrument is well adapted for measuring either horizontal angles or magnetic bearings with such degree of accuracy as can be obtained without optical aid. The graduated circle is 12 inches in diameter, divided into five minutes, and read by a single vernier. The levels are somewhat singularly placed on the beautifully engraved face of the compass.

A few notes on the complicated history of the Pennsylvania and Maryland boundary will not be out of place. They provide an instructive example of the difficulties which arise from imperfect description of a little-known territory. The Charter of Maryland, granted to Cecil, second Lord Baltimore, in 1632, included the whole of the peninsula east of the Bay of Chesapeake and the territory as far as 40° north *hactenus inculta*. The grant in 1681 to William Penn included the territory lying east of the Delaware River from 12 miles north of Newcastle to parallel 43°. The original grants thus overlapped, since Newcastle and even the city of Pennsylvania itself is south of parallel 40°. Moreover, the peninsula having

been settled by the Dutch before effective occupation by Lord Baltimore, had, on the relinquishment of the Dutch claims, reverted to the Crown as not *hactenus inculta*, and had been later bought by William Penn. After more than half a century of dispute and a long suit in the Court of Chancery, an agreement was at last signed in 1760 with the following remarkable definition of the boundary :—

A due east and west line should be run across the peninsula from Cape Henlopen to Chesapeake Bay, and from the exact middle of this line should be drawn a line tangent to the western periphery of a circle having a radius of 12 statute miles measured horizontally from the centre of the town of Newcastle. From the tangent point a line should be drawn due north until it cut a parallel of latitude 15 miles due south of the most southern part of the city of Philadelphia, this point of intersection to be the north-east corner of Maryland. Thence the line should run due west on the same parallel as far as it forms a boundary between the two states.

This agreement represented a certain advance in the technique of boundary making. In half a century of argument it had been decided that it was improper to measure differences of latitude in miles; and that the distances must be measured horizontally and not along the surface of the ground. But the agreement gave no precise definition of the centre of one town or the most southern point of another; nor did it lay down whether a certain arm of Chesapeake Bay should be reckoned as part of the bay or not.

The main difficulty of the Commissioners, however, having settled the middle point of the transverse line, was to cut a tangent to the circle about Newcastle; and after two expensive attempts had failed the proprietors were compelled to call in the help of Charles Mason and Jeremiah Dixon, the first an astronomer and assistant to Bradley, the second a surveyor of Cockfield, in Durham—both of whom had been employed by the Royal Society to observe the transit of Venus in 1761 at the Cape of Good Hope. Mason and Dixon began work in 1763, and succeeded in running the tangent line with sufficient accuracy; but at an early stage of the work it occurred to them to recommend to the Royal Society that advantage should be taken of this opportunity of measuring an arc of meridian, the first in North America. They then cut north to the agreed parallel 15 miles south of the southern point of the city of Pennsylvania, and thence westward along the parallel which is the actual Mason and Dixon line.

Within recent years this boundary has been re-surveyed by a mixed Commission under the Superintendent of the Coast and Geodetic Survey. They re-located the marks which had been lost, and the report published by the Maryland Geological Survey in 1908 gives an exhaustive account of the whole original dispute, and the bibliography of the documents for its study—failing singularly however to make clear the essential points, which are the terms of the original grants, and the manner in which the

boundaries were defined. The re-survey established the great accuracy of the work of Mason and Dixon, whose latitudes were only two or three seconds in error—a very creditable result for the time.

While the descent of our Theodolite from Jeremiah Dixon is completely established, it is not quite clear that the instrument was actually employed upon the boundary work, though research into the records of the survey preserved in Philadelphia and Baltimore may, it is hoped, throw light upon this question.

The instrument is in any case a welcome gift, as a personal relic of a man so well known in the history of Geography, and as a beautiful example of the workmanship of the period. Such gifts help to realize the ambition expressed by Sir Clements Markham in his recent paper, that the Society might possess a collection of instruments for navigation and survey representative of all periods.

A. R. H.

RAILWAY DEVELOPMENT OF AFRICA, PRESENT AND FUTURE.

Sir Charles Metcalfe, Bart.

Read at the Meeting of the Society, 29 November 1915. Map, p. 80.

THE outstanding feature of Africa has been its inaccessibility. This vast continent, covering one-fifth of the world's land area, with its enormous treasures of diamonds, gold, copper, tin, iron and coal, with its products of oil, rubber, coconuts, and such a wealth of tropical fruits that its millions of inhabitants can exist with a minimum of labour, with a great central plateau running for thousands of miles at such an altitude that white races can live and thrive in a climate that makes them reluctant to leave it, has yet, in spite of all these advantages, remained untraversed and unknown to the civilized world until comparatively recent times. The only accessible part of Africa, the Valley of the Nile, gives us our earliest historical record. A navigable river in a fairly temperate zone defended on either side by deserts gave all the factors that produced a high state of civilization when, as far as we know, the rest of the world was in a state of barbarism. South America and India resemble Africa in shape, but differ from it in this respect, that whereas they have in each case a mountain range running north and south on their western shore only, Africa has a formidable barrier varying in altitude generally from 3000 to 8000 feet all round its coastline, both on the west and on the east. The rivers south of the equator are very few and impossible for navigation except in some instances for a short distance, above which rapids, caused by the abrupt rise of the country, stop all access by boats to the interior.

The large rivers, the Senegal, the Gambia, the Niger, and the Congo, are in the tropics, and though navigable for long distances, the dense forests, fever, and the unhealthy climate have prevented outsiders from penetrating at all far away from the rivers, whilst the native, having no stimulus for storing energy, did not emerge from barbarism.

Protected then on the north by the Sahara and all round its west and east coasts to its most southern point, the interior of the great continent of Africa remained unknown. It is possible that central Africa was explored in very early times by some foreign race, but the mystery of Zimbabwe remains unsolved. We know nothing of the people that exploited the gold-mines of South Africa. The fact that old workings have been discovered over an area of more than 40,000 square miles, and that many million pounds' worth of gold have been taken out of those mines without our having any information about it, show clearly that the mining must have been continued over a very lengthy period and that it must all have happened a long time ago, for such an output would have attracted considerable notice, and would indeed have upset the markets of the world if it had taken place at any time in the last two thousand years. These old workings were stopped at water-level, generally 50 or 60 feet below the surface of the ground, and what became of that mining race we do not know. Perhaps they were a small dominant class using slave labour and were exterminated by some sudden rising of the natives. Possibly they left because below the water-level they could not work the gold.

Galton says that energy, an attribute of the higher races, is eminently transmissible by descent, and a race that showed such a capacity for labour in Rhodesia must have made history if it had remained in that country, but there was no sufficient inducement when gold production ceased for any energetic race to stay in the country where there was no means of communication. There was no navigable river; a Via Appia if constructed would have been almost impossible to maintain in the country between Rhodesia and the port of Sofala, where 13 inches of rain frequently fall in a few hours. The camel for the same reason was impossible. The horrors of the slave trade, against which Livingstone and Cardinal Lavigerie raised such a stirring appeal, were mainly due to the fact that ivory from Central Africa could only be carried to the coast on human heads. The difficulty of access locked up the African continent. When tempted by the riches of the East the Portuguese sent Bartholomeu Diaz and Cavilhao, Vasco da Gama and Dom Francisco de Almeida to find and secure a route to India round the coasts of Africa, resting-places were established by them at Benguella, Sofala, and Mozambique, but only two attempts were made by them to penetrate the interior, and both of these, the one to Prester John's country and the other under Baretto to the kingdom of Monomatapa, ended in disaster.

The Dutch, French, and English ships all used Table Bay as a halfway

house on the road to India, but they none of them made any effort to go in from the coast. The Dutch who settled at Cape Town in 1652 were very slow in extending their farms inland, but they did push the Huguenots into the Drakenstein Valley, some 30 miles from Cape Town, which was then on the outskirts of the civilized area, and from that time onward the farms were gradually extended inland; but there was very little done in this way until after the English, who carefully secured every one of the places that Napoleon had marked out as the vital spots of the world, bought the Cape Colony from the Dutch in 1806. Gradual settlements were made from that time on all along the coast from Cape Town to Natal. But no settlements were made beyond the mountain barrier until the few irreconcileable Boers broke away and trekked to the Orange Colony and the Transvaal, and the ox-waggon remained the only means of transport.

George Thompson, in his book called 'Travels and Adventures in South Africa,' discusses the possible means of communication whereby an export trade could be developed, and states that in South Africa "canals and railways are entirely out of the question." This book was published in 1827, only two years after the opening of the Stockton and Darlington Railway, the first that was ever opened for traffic; and this opinion of Thompson's was reasonable enough. The small locomotive of that period did not give much promise of hauling trains of merchandise over the great mountain ranges that encompass South Africa. It was not till 1857 that an Act was passed for the construction of 54 miles of railway from Cape Town to Wellington. A contract was made by Sir George Grey, Governor of the Cape Colony, with the Cape Town Railway and Dock Company in December 1858 to make this line under a six per cent. guarantee from the Government, for whom Sir John Hawkshaw was the referee. Sir Charles Fox was the consulting engineer of the company, William George Brounger was the engineer of the company in South Africa, and Edward Pickering was the contractor. The gauge was 4 ft. 8½ in., and the weight of rails was 70 lbs. per lineal yard, and the cost was about £400,000. The branch from Salt River to Wynberg was also constructed by this company, which was finally wound up after the purchase of these railways by the Government of the Cape Colony in 1873, the year after they first got responsible government.

In 1869 the Diamond-fields were discovered 650 miles inland from Cape Town, and there was a rush to the Vaal River and to Kimberley in 1870. But there was evidently no conception on the part of the Cape Government of the great industry that would result from this discovery, for after purchasing the Cape Town and Wellington Railway, which was of the same gauge as we have in England, they converted it into a 3 ft. 6 in. gauge, which has unhappily remained until now the main line gauge in South Africa. This has been a great handicap to the trade and

development of a country of great distances, as the speed on a 3 ft. 6 in. gauge is only half what it is on a 4 ft. 8½ in. gauge. All efforts to change this gauge to the standard gauge of Europe have been ineffectual. It was pointed out that the extra cost of 4 ft. 8½ in. as against the 3 ft. 6 in., as shown by alternative tenders, was very small. It was shown that a break of gauge, which is a serious matter on lines of short distances, is of no great account when the runs are 1000 or 2000 miles long, and that in Egypt the cost of transfer of goods per ton where there is a break of gauge is estimated to be about a piastre or 2½*d.* of our money. But it was of no avail and no change has been made yet; it will have to be made some day, and the longer it is put off the greater will be the expense of effecting the change.

In 1874 the commencement of a line north from Port Elizabeth was made, one from East London in 1876, and one from Durban in 1878. The Cape Town-Kimberley line was added to section by section and reached Beaufort West in the Karoo country in 1880. There has always been a certain amount of jealous competition between the ports of Cape Town and Port Elizabeth, and so we are not surprised to find that the railways from these places towards Kimberley which met at De Aar Junction 500 miles from Cape Town were opened on the same day, 31 March 1884, and on 28 November 1885 the railway was opened to Kimberley. This year was memorable for the Warren Expedition and the successful effort of Cecil Rhodes to prevent Kruger from pushing his people across the main road from Cape Colony to the north. To most people at that time the north was merely the happy hunting-ground of adventurous sportsmen in the pursuit of big game, but Rhodes always laid it down as a sort of dogma never to despise any great stretch of country, and he steadily kept his eye on these northern territories; but for him our leading statesmen would have gladly consented to give away the whole of the interior and to have let German South-West Africa link up with German East Africa. After 1885 there came a lull in railway construction. Kimberley was for the time the limit of the civilized world in South Africa, but the discovery of gold in Johannesburg made that place a fresh centre of attraction further inland, and as the value and prosperity of the gold industry steadily improved a new factor was introduced into South African politics. The four chief ports, Cape Town, Port Elizabeth, East London, and Durban, all wished to compete for this new centre of trade. Kruger, however, who saw what a difference the gold industry of the Rand was going to make in the financial and political importance of the Transvaal, and who was suspicious of the advance from the Cape Colony, declared that he would have no railway until that from Delagoa Bay was made. He wished to isolate his country from the rest of South Africa until he had got an independent outlet. Rhodes, writing to the *Argus* in 1887, said: "I feel that the present is an opportunity that may not recur; the Free State is in the humour to join hands with us to mark its resentment at the policy of isolation pursued by the Transvaal, and if

the right steps are taken promptly the Delagoa Bay Extension Railway, which would send all the Witwatersrand traffic through Lourenço Marques will not be made for years. It is emphatically a case of the first in the field; if we are first and make good our grip we shall not be soon or easily disposed of." This opportunity was not, however, taken advantage of. It was in this year that Piet Grobelar was sent up by Kruger to try and come to terms with Lobengula, the chief of the Matabele. Rhodes urged the High Commissioner to stop this flagrant breach of the Convention of 1884, upon which the independence of the Republics rested, and to proclaim a formal protectorate over all the country to the north. This the High Commissioner refused to do, but he did agree to send Mr. Moffat up to Lobengula, and the latter signed a treaty with him that he would not give any concession of his country to any foreign state or power without the previous knowledge or sanction of Her Majesty's High Commissioner in South Africa. In the following year Lobengula signed the concession which, with the amalgamation of certain other interests, was the basis of the British South Africa Company incorporated by Royal Charter in October 1889. One of the points in the charter was that railways would be made in connection with the new territory. And in that same month of October 1889 an agreement was signed by Rhodes for the British South Africa Company, and by the Cape Government, by which the Cape undertook to construct the railway from Kimberley to Vryburg. This agreement was used by the Cape Government as a lever with the Orange Free State to allow the extension of the Cape Railways into their country, and in December 1890 the line from Kimberley to Vryburg and the line from Naauwpoort to Bloemfontein were both opened for traffic. The eagerness of the Cape to get to Johannesburg with their railways led to an agreement in 1891 with Kruger, who in consideration of money to be furnished by the Cape Colony, to enable him to extend the Delagoa Bay line to Pretoria, consented to the Cape Colony extending their line from Bloemfontein to Germiston in the middle of the Rand goldfields. This latter line was opened in September 1892. Natal had still to cart goods for Johannesburg by ox-waggon from Charlestown, and was not connected by rail with Germiston till 1895. The fight between the ports of the Cape Colony and Natal and Delagoa Bay for the Johannesburg traffic continued from that time until the Union of South Africa. On the route to the north the line from Vryburg to Mafeking was opened in 1902, and in the same year a line from the Port of Beira in Portuguese East Africa was commenced towards Rhodesia, where the settlers were in urgent need of better communication than that afforded by the ox-waggon. Our experiences in the construction of the Beira Railway give one a good idea of the inaccessibility of the country at that time. The Administration were receiving messages that people were starving—partly it must be admitted because they were not inclined to eat native food when the English food to which

they had been accustomed was unobtainable. Without a railway it took three weeks to go even the 300 miles from Bulawayo to Salisbury, and to make the railway was imperative. Money was very scarce, and in order to get the line as far as possible it was necessary to utilize such stretches of river as were navigable For the first 30 miles the ground was under water, the mosquitoes were very bad, and a path had to be cut through the jungle, where then one could not see a yard ahead, and where now it is difficult to believe that there had been any trouble. Sickness carried off half the staff. The value of quinine was not known and all the people were thin and yellow. Now one passes through the country in a beautiful railway carriage and cannot realize the original difficulties. Everybody looks rosy-cheeked and healthy simply because now they have proper food and attention. In 1893 Matabeleland was occupied and several proposals were made to connect Mafeking with Bulawayo by a light railway, but it was not until 1896, after the Matabele rebellion and after rinderpest had caused such ravage amongst the cattle of the country, that freight from Mafeking to Bulawayo, a distance of 600 miles, was costing £200 a ton, that Mr. Rhodes at last saw that railway communication was an absolute necessity; he therefore sanctioned the construction of the extension of the 3 ft. 6 in. railway to Bulawayo. The people were urging their starvation. They were paying 4*s.* a-piece for eggs. Mr. Rhodes therefore sanctioned the construction of the extension to Bulawayo, and within a year, by the great efforts of Mr. George Pauling, the contractor who has done so much for the railway development of South Africa, the line was opened in November 1897.

From that time forward Mr. Rhodes was a convinced believer in the necessity of railways for opening up a country, and he put his great energy and will power into the financing of railway construction. The line from Beira to Salisbury was completed in 1899, and the section between Salisbury and Bulawayo was opened in 1902. From Gwelo, a town on that section, it was proposed to run the main northward extension of the railway across the Zambezi River at the beautiful Kariba Gorge, some 250 miles below Victoria Falls, and continue along the Luangwa Valley through North-East Rhodesia to Lake Tanganyika, but the difficulties beyond the Zambezi were very great, and this proposal was abandoned. It was thought more advisable to continue the line from Bulawayo past the Wankie Coal-mines to the Victoria Falls, and this line was opened in 1904. From the Victoria Falls the railway has been extended through North-West Rhodesia past the lead and zinc mine of Broken Hill and the Bwana M'Kubwa copper-mine for a distance of 507 miles to the Congo border, which was reached in 1909; it was thence extended through the great copper districts of Katanga, passing from Elizabeth-ville to Kambove through 100 miles of copper-mines, and has since been further constructed to the Biano plateau on its way to Bukama, from which it is now 100 miles distant, the length of the line from

Cape Town being 2500 miles. During these latter years various railways were constructed in the Orange Free State and the Transvaal, opening up and developing those districts. The position now is that under the administration of the British South Africa Company there are about 2465 miles of railway, and under the Union Government about 8500 miles, to which, I presume, we may now add, thanks to the successful campaign under General Botha, about 1400 miles of railway in German South-West Africa. In August last General Botha, speaking at the South Africa Party Congress at Bloemfontein, stated that of the public debt of the Union, which amounted to £131,000,000, over £114,000,000 was reproductive expenditure, being the value of railways, harbour, telegraphs, and telephones. The Union Government Railway Department played a most important part in the recent German South African Campaign, and they deserve great praise for the way in which they linked up the Union Railway system from Prieska past Upington to the railways in German South-West Africa, some of this construction being made at record speed.

In Portuguese East Africa, besides the main Delagoa Railway from Lourenço Marques to the Transvaal frontier, a short 3 ft. 6 in. line of 44 miles has been built from that port to Goba, a point 7 miles from the Swazi border. The Inkomati Railway from Moamba on the main line to Shinavane was opened in November 1914; there is a Decauville ·75 metre gauge line about 70 miles long from Chai Chai to Jenabai; and from Inhambane a 3 ft. 6 in. railway has been made southward to Inharrime.

One of the projects of Mr. Rhodes was a Transcontinental Telegraph to extend from Cape Town to Alexandria. In connection with this matter and with the Cape to Cairo Railway scheme he interviewed King Leopold at Brussels, in the beginning of the year 1899, but he could arrange nothing with him. King Leopold's terms were impossible. In March of that year Mr. Rhodes had several interviews with the Kaiser in Berlin, and an agreement was come to by which the Transcontinental Telegraph was allowed to be constructed from the northern border of North-East Rhodesia through German East Africa to Nairobi in British East Africa; permission was also granted to construct a continuation of the Cape to Cairo Railway through German territory, and the permanent-way material for this line was to be carried over a proposed German line from Dar es Salaam. The German Colonial group had proposed to make their main line from Dar es Salaam to the north-east corner of Lake Nyasa, but it was pointed out to them that a line of wider scope would be from Dar es Salaam through Tabora to Ujiji halfway up Lake Tanganyika. This was the route finally adopted, and this railway of metre gauge 778 miles in length was opened for traffic in February 1914, from Dar es Salaam to Kigoma, near Ujiji, having cost nearly seven millions of money. The Germans have also constructed a line called the Usambara Railway

from Tanga to Moshi at the foot of Kilimanjaro of 220 miles in length. In Nyasaland, which was much handicapped by the difficulties of navigation on the Zambezi and Shiré rivers, a railway of 3 ft. 6 in. gauge was constructed by the Shiré Highlands Railway Company from Port Herald to Blantyre, which was last year extended down to the Zambezi River at Chinde, and a line is being constructed by the Portuguese from Kilimane to the Shiré River. To the north of Kilimane the Inhamacurra and M'Kuba railway, 32 miles in length, has been built to a ·75 metre gauge. British East Africa, rescued by the efforts of Sir William Mackinnon and others from the German clutch, was taken over by the British Government in 1895, and a metre-gauge railway from Mombasa, on the east coast, past Nairobi to Victoria Nyanza was completed in 1902, a distance of 582 miles. No statement has ever been made of the reason why the railway was built upon the metre-gauge, but it may be noticed that in case of military necessity the scanty rolling-stock of the Uganda Railway might be most quickly supplemented from the metre-gauge railways of India.

From Jinja the Busoga Railway to Namasagali, a port on Lake Kioga, (a distance of 61 miles) was opened in 1914. This line has been made to open up cotton districts. A branch line has also been made connecting the great soda lake of Magadi with the Mombasa railway near Kiu, and a line has been made from Nairobi to Thiki towards Mount Kenya. In French Somaliland a line of metre gauge was commenced in 1897 by a private company from the Port of Jibuti which reached Diré Dawa, a distance of 192 miles, in 1902. This company was finally taken over by the Franco-Ethiopian Company in 1909, and the railway has now been extended to Addis Abbaba in Abyssinia, a further distance of 300 miles. At this point the line is at an altitude of 7732 feet. In Eritrea (Italian Somaliland) a short line of 95 miles has been made from Massawa inland through Asmara to Cheren.

In the Sudan, which has an area of a million square miles, Ismail Pasha forty years ago started a railway from Wadi Halfa southwards, but only 33 miles were made and it was then abandoned. In 1884 an abortive attempt was made by the British Government during the military expedition to make a line from Port Suakin, soon abandoned.

In connection with the Sudan expedition against the Mahdi the railway from Wadi Halfa was completed to Abu Hamed in 1897, to Atbara in 1898, the year that Khartum was captured, and to Khartum, a distance in all of 578 miles, in 1899. In connection with this military railway made by Lord Kitchener it may be noted how one part of the British dominions can and does help another. When Lord Kitchener could not get locomotives the Rhodesia Railway, which was then called the Bechuanaland Railway, handed over to him for his work in Egypt five locomotives that they had ready in England, which assistance Lord Kitchener said saved him a year's campaign.

In 1904 the line between Atbara and Suakin, 305 miles in length, was commenced from both ends and completed in 1906, a branch being made to Port Sudan, which gave better facilities than Suakin for handling traffic. In 1910 the railway was extended from Khartum to Sennar on the Blue Nile, from which point the railway was made due west to Kosti on the White Nile, a distance of 238 miles from Khartum, and has since been extended a further 192 miles to El Obeid, the centre of the gum trade in the province of Darfur. From Aswan to Wadi Halfa, a distance of 210 miles, there is as yet no railway, the traffic being carried on the Nile.

In Egypt proper the line from Alexandria southwards was started by Abbas Pasha in 1852. It has now been built past Cairo as far as Luxor with a 4 ft. 8½ in. gauge and from Luxor on to Aswan with a 3 ft. 6 in. gauge. In the delta there is a network of railways connecting Alexandria and Cairo with Port Said and Suez, and narrow-gauge railways have been made to Kharga past Fayum; the Khedive also commenced a railway on the Decauville system from Lake Mariut westwards along the coast towards the Gulf of Sollum, which was constructed for some 120 miles to Abu Hagag and later taken over by the State Railways.

The State Railways own 1828 miles of 4 ft. 8½ in. gauge and 137 miles of 3 ft. 6 in. gauge; of the light narrow-gauge railways there are 823 miles in all.

To the west of Egypt there is a short railway of 19 miles from Bengasi to Benine, which perhaps was intended to join the late Khedive's railway from Lake Mariut to Abu Hagag.

In Tunis there are about 1144 miles of railway, of which 278 miles are of broad gauge, and in Algeria there are 1180 miles of broad gauge and 1118 miles of narrow gauge. Algeria and Tunis have chiefly coast-lines connecting up Oran with Algiers, Constantine, Tunis, and Sfax, with branches towards the desert. The line which has been constructed from Oran to Colomb-Bechar, a distance of 465 miles, is spoken of as the first section of the trans-Sahara railway.

In French Morocco the railway from Casablanca to Fez has been completed, and work commenced on the Casablanca-Marrakesh line.

In Senegal, famous for its produce of ground-nuts, a railway 165 miles in length, was made from Dakar to St. Louis at the mouth of the Senegal River in 1885. This river after the rainy season is navigable as far as Kayes, but in the dry season only as far as Podor. From Ambidedi, near Kayes, a line to Kulikoro, 346 miles in length, was opened in 1904, and between Thies and Kayes, a distance of 425 miles, a railway is being constructed from both ends, of which about 248 miles have been made, and a short branch has been made to Kiolak. Southwards of Dakar the Gambia River being navigable is utilized for traffic. To the south of the Gambia, in French Guinea, a railway from Konakri was finished to Kurussa in 1910, a

distance of 367 miles, since extended 43 miles to Kankan. At Konakri ocean steamers can discharge and load alongside the wharf.

In Sierra Leone from the fine harbour at Freetown the first railway in British West Africa was commenced in 1896, and has been constructed on a 2 ft. 6 in. gauge to Pendembu, a distance of 228 miles, and also a branch of 90 miles has been made from Boia to Makene. Further east the next railway is in the French territory of the Ivory Coast, where there are only surf harbours at Port Bouet and Grand Bassam, and goods have to be twice transshipped before reaching the commencement of the railway at Abijan. This line is of metre gauge, as are all the French railways in West Africa, and extends to Bwaké, 194 miles.

In the British territory of the Gold Coast the railway from Sekondi to Kumasi, 168 miles in length, was commenced in 1898 and finished in 1904 with a gauge of 3 feet 6 inches, and was built in the interests of the gold-mining industry and the cocoa and timber trade. There is also a branch line of 20 miles to Prestea. There is also a line from the bad port of Accra of 39 miles to Mangoase, since extended another 13 miles to Koforidua. In Togo Land, which was recently German, there is no good port, but a metre-gauge line of 118 miles was constructed from Lome to Misahöhe in 1907, and also a line from Lome to Atakpame of 104 miles, with a coast railway of 27 miles from Lome to Anecho.

In the French territory of Dahomey there is a surf harbour at Kotonu, and from there a metre-gauge line, 162 miles, has been made to Savé, a portion of a line of 458 miles proposed to Gaya on the Niger River. There is also a branch from Paku to Lake Aheme of 20 miles, and a tramway from Porto Novo to Sakete and Pobe of 46 miles.

In British Nigeria the railway commences at Iddo near Lagos and goes through Yoruba, a province with densely populated towns, to Jebba, a distance of 307 miles. This was commenced in 1896 and finished in 1909. Northern Nigeria, with an area of 255,000 square miles, was taken over from the Royal Niger Company in 1900 by the Government.

In 1907, when Sir Percy Girouard was High Commissioner, money was advanced by Southern Nigeria to construct the line from Baro on the Niger River, through Minna and Zaria to Kano, 356 miles in length. This was opened in 1911. Since then the line has been completed from Jebba through Zungeru, the capital, to Minna. The whole of this railway is 3 ft. 6 in. gauge, but a branch of about 141 miles from Zaria towards the Bauchi Plateau is constructed on the 2 ft. 6 in. gauge. Sir Walter Egerton did much to improve the Port of Lagos, but the port of Forçados at the mouth of the Niger is said to be very much better and can accommodate ocean steamers. In 1913 Lieut. R. H. Hughes of the Nigeria Marine discovered a good harbour on the River Bonny, now named Port Harcourt, and from this port a railway is being constructed northwards to cross the Benue River between Loko and Ibi to join the main

line to Kano at Kaduna, south of Zaria, a distance of 450 miles. 147 miles of this railway was opened for goods traffic in March 1915 as far as Enugu-Engwo near the Udi coalfields. The Cameroons, with its area of 290,000 square miles, was left without railways for some time, the traffic being carried on the rivers, but the *Mittellandbahn* of 175 miles has been made from Duala to the Njong River, and the *Nordbahn*, 100 miles in length, commencing on the opposite side of the Wuri River from Duala to Kongsamba, a neck in the Manenguba Mountains, was opened in 1911.

In the French Congo a line has been commenced from Brazzaville to Pointe Noire, a distance of 362 miles.

In Belgian Congo a short line has been built from Boma to Buku Chela which was opened in 1914. From its mouth the Congo River is navigable for ocean steamers for 85 miles up to Matadi. From Matadi to Dolo and Leopoldville on Stanley Pool a line of ·75 metre gauge, 247 miles in length, commenced in 1890, was completed in 1898. From Stanley Pool, which the French line from Pointe Noire to Brazzaville will also tap, the Congo is navigable for about 1000 miles as far as Stanleyville, and is used by steamers of 500 tons. From Stanleyville to Ponthierville, a railway 78 miles long was constructed in 1907 to avoid the Stanley Falls. From Ponthierville to Kindu, a distance of 200 miles, the river is navigated by tugs and barges. From Kindu to Kongolo a railway 217 miles in length was constructed in 1907 to avoid the rapids. From Kabalo, south of Kongolo, a railway has been made eastwards connecting the Lualaba River with Lake Tanganyika at Albertville. From Kongolo the river is navigated by tugs and 200-ton barges for 400 miles up to Bukama, the point which the railway from Cape Town through Kambove is approaching.

In Portuguese territory there is a railway from Loanda to Ambaca, 226 miles in length, extended now for another 8·7 miles to Malange, of metre gauge with a short branch to the north. In Portuguese Angola the Benguella Railway, commencing at the fine harbour of Lobito Bay, has been, through the initiative and resource of Mr. Robert Williams, constructed of a 3 ft. 6 in. gauge for 392 miles to Bihé on the high Angola plateau at an altitude of 5000 feet above sea-level. Further south in Portuguese Angola there is a line of 105 miles from Mossamedes to Lubango and the Chela mountains.

In German South-West Africa, which has an area of 322,446 sq. miles, the first railway was a light military line of ·6 metre or 23·6 inch gauge. It was commenced in 1897, and built without any regular survey from Swakopmund to Karibib, a distance of 121 miles. From Karibib, after a proper survey had been made, it was completed in 1902, a distance of 116 miles to Windhoek, which is at an altitude of over 5500 feet above sea-level. The railway from Swakopmund to the copper-mines of Otavi and Tsumeb, a distance of 354 miles, was commenced in 1903 and completed

in 1906. It was built by the Otavi Mines and Railway Company, who also built a branch from Otavi to Grootfontein, a length of 56 miles, in 1909 in connection with their large land grants. These railways were taken over by the German Government, and a junction has since been made from Karibib to Onguati on the Otavi line. The line from Windhoek to Keetmanshoop, a distance of 317 miles, was made by the Government chiefly for military purposes on a 3 ft. 6 in. gauge in 1912. The line from Lüderitzbucht to Keetmanshoop, 227 miles in length, of a 3 ft. 6 in. gauge, was completed in 1908, and later extensions were made from Seeheim to Kalkfontein, 115 miles, and from Kalkfontein to Warmbad, 25 miles, and from Kalkfontein to Nababas, 65 miles. A line was also made 60 miles in length from Kolmanskop to Bogenfels along the coast in connection with the diamond fields industry. These railways, which have cost nearly six millions of money, are about 1400 miles in length in all, and have now been taken over by the Union Government of South Africa and connected up with their own system of railways.

Having dealt with the existing railways in Africa, which are mostly coast lines being gradually extended into the interior, we will now examine the various projects in order, working from the south up the east coast and round by the north and west coasts back to Cape Town.

Inaccessible Africa has been made accessible through the efforts of explorers, missionaries and shipping companies, private companies and governments and their engineers. By the expenditure of much money and at a great cost of life, the barriers around Africa have been surmounted and the way opened to the plateau of the interior.

The Union of South Africa are constructing during this year some 810 miles of local railways, of which 300 are in the Cape Province, 163 miles in the Orange Free State, 212 miles in the Transvaal, and 135 miles in Natal. In Rhodesia there are about 550 miles of local lines projected. From the Port of Beira a line is proposed to Chindé on the Zambezi River to connect Blantyre and later Lake Nyasa with that port. From the harbour of Mokambo Bay, close to Mozambique, a line is projected to the Namuli Mountains and Nyasaland. From Port Amelia on the south shore of the fine harbour of Pemba Bay a line is proposed to the southern end of Lake Nyasa. A line from Karonga on the north end of Lake Nyasa to Kituta on the southern end of Lake Tanganyika, practically along the Stevenson road, the boundary between North-East Rhodesia and German territory, has also been mooted.

The German East African projects were a line from Kilwa Kivinje to Wiedhafen on the north end of Lake Nyasa, a railway from Bismarckburg near the southern end of Lake Tanganyika to Kilossa, and an extension from Moshi to Nassa on Lake Victoria Nyanza, in order to tap traffic now going by the Mombasa railway. Also a line from Tabora to the Kagera River in the Ruanda Province, with a branch to Mulesi on the

southern end of Victoria Nyanza. In British East Africa a line is being surveyed from Nakuru on the Mombasa railway towards Busoga.

From Itala on the coast of Italian Somaliland a line has been projected to Addis Abbaba in Abyssinia, from which point an extension is proposed to Gambela, a town on the river Baro leased to the Sudan Government. The river Baro is navigable for a few months and is used for trade between Gambela and Khartum. From Diré Dawa a branch is proposed to Harrar. From Asmara in Eritrea a line is projected southwards to Addis Abbaba and one from Cheren to Agordat.

In the Sudan a line is to be built from Thamiam, a point on the Suakin-Berber railway to Kassala, with a probable extension to Gedaref and Sennar, and also an extension from El Obeid to El Fasher in the Province of Darfur, and a line of 50 miles has been surveyed from Suakin to Tókar. In Tripoli some extensions of the existing short lines are projected, and two large schemes are talked of, the one from Tripoli to Lake Chad and another from Benghazi towards the oasis of Kurfara.

In Algeria it is proposed to connect the iron-mines of Wenza and Bu Kadra with Bone Harbour, and there are proposals for extending the line from Constantine and Biskra and Tuggurt southwards to Wargla, and from Algiers to El Golea and from Ujda to Fez, part of which is already built. A railway has also been authorized from Tangier to Fez. The French proposals in West Africa are a line joining the railway in Senegal from Dakar to Kayes with the line from Konakri in French Guinea; extensions from Bamako on the Niger near Kulikoro to Buguni and from Kankan to Buguni; an extension from Buguni to Boromo and Wagadugu on to Ausongo; a line from Kankan to Dimbokro on the Abijan-Bwaké Railway; an extension from Bwaké to Boromo and a line from Wagadugu to Paraku, on the proposed extension of the line from Savé to Gaya on the Niger, and also a short connection between Porto Novo and Kotonu.

In the Gold Coast a junction between Koforidua and Kumasi has been projected and also a cross line joining the two railways from Sekondi and Accra on the 6th parallel north. In Togoland there was a proposed extension from Atakpame to Sansane Mango. In British Nigeria there is the proposed extension from Enugo-Engwo to Kaduna.

In the Cameroons the Germans had suggested a line which left the existing railway at the Njong River and went in a north-easterly direction through Bertua, Kunde, and Bibene to Lake Chad, with several branches east and west. There is also a projected line from Bertua to Singa on the Ubangi River, and another from Njong River south-west to Wesso on the navigable Sanga River.

In French Congo there is a scheme for a line of 125 miles from Njole on the Ogowe River to Kanjama, and also for a line 216 miles in length from Bangi to Fort Crampel, connecting the Ubangi and Shari Rivers.

In Belgian Congo it is proposed to extend the Boma Lukula Railway to Buku Dungu. There is also a big project of a line from Stanley Pool *viâ* Lusambo to Bukama, with a branch to Kabalo, and another from Kabalo on to Lake Mweru. There is also an alternative route surveyed from Dolo to Bukama. From Stanleyville a line has been surveyed to Albert Nyanza and also a line to connect this railway with Lake Tanganyika.

In Portuguese West Africa an extension is proposed of the Loanda Malange Railway to the Kasai River on the frontier of the Congo territory. Further down on the 12th parallel the Benguella Railway, which has reached the high plateau, is being extended over a level stretch of country to the frontier of the Belgian Congo where it will be linked up with a line of the same gauge that is to be constructed from Ruwe and Kambove, the centre of the copper and other mineral deposits of Katanga. It is also proposed to extend the Mossamedes Lubango Railway to the Kubango River.

In German South-West Africa a line was projected from Otjiwarongo on the Swakopmund-Otavi Railway across the Kunene River to Great Fish Bay in Portuguese Angola, part of which has been completed, and also a branch from Windhoek to the east to Gobabis.

These are the railways—commercial, political and military—which have been built and projected, and we now come to the more difficult task of gratuitous prophecy of the railways of the future. The history has been that, owing to the difficulty of getting funds, wherever it has been possible to utilize rivers, traffic has been carried on by steamer or boat, railways being made to work in conjunction with river traffic. Naturally, as trade increases the railways will be made continuous, the rivers being still used as feeders. This network of veins of railways which are steadily being pushed forward into the centre of Africa must inevitably connect, in the future, with great arteries going north and south through the continent.

When the line from Kambove to Bukama is completed and the railway from Stanleyville to Albert Nyanza is made by the construction of a short line of 100 miles in length from Dufile to Rejaf near Gondokoro, communication will be effected by rail or steamer from Cape Town to Alexandria and Port Said, and a short connection between Port Said and Jerusalem would link up railway communication between Africa and Asia Minor. From Stanleyville it is almost certain that a railway will be made to Lake Chad, and as French surveys have already been made from Algeria to Lake Chad, it seems possible that even across the Sahara Desert, so painfully traversed by Barth and others, a railway will be made which will join up Cape Town with Algeria, and which with a tunnel from Ceuta to the Spanish coast would give an overland connection with Europe. From this Trans-Saharan line connections will of course be made, probably with Timbuktu on the west and the province of Darfur on the east.

Very rich men are often in great doubt how to leave their wealth in such a way that it shall be beneficial and not harmful to humanity; they cannot do better than follow the example of Mr. Alfred Beit, who besides bequeathing large amounts for education, left two millions of money in trust for the purpose of financing railways in Rhodesia. The idea in this very fine will was that the money should be expended in the construction of railways which were necessary, but which possibly would not pay for some years, and as soon as these railways were paying their four per cent. and five per cent. interest, which appeals to the public, the money should be utilized again for further railways. It is hoped that this money may be available for the construction of a railway from Broken Hill in North-West Rhodesia, through North-East Rhodesia, one of the great cattle producing countries of the world, to the south end of Lake Tanganyika, and extended thence through Tabora to the railway in British East Africa, and by a further extension from that railway to Senaar in the Sudan another all-through-Africa route will be provided.

It would seem scarcely necessary to point out that these great arteries are not made for the purpose of reaching Cape Town; they will be great channels of trade passing through vast territories capable of enormous development and occupied by millions of people, whose numbers are increasing rapidly now that slave raiding is done away with and that tribal wars are almost a thing of the past.

They will be great arteries connected with the coast on all sides by a network of railway veins to and from which there will be a constant and ever-increasing flow of traffic until what was inaccessible Africa will lie open to all, a smiling, prosperous, and civilized continent.

The PRESIDENT: We are going to listen to-night to a lecture which I am sure will be of great interest on the Railroad Development of Africa by Sir Charles Metcalfe, who is as well qualified as any one in this country to tell us all that can be known on that subject. Sir Charles Metcalfe was from very early years an intimate friend of Mr. Rhodes, and was in constant contact with him all his life. He has done as much as any man living for the development of Rhodesia. I believe, if I may introduce a personal element, that when the British Association went to Rhodesia it was largely due to Sir Charles that we owed our delightful visit to the Victoria Falls. I will ask Sir Charles to read us his paper.

(*Sir Charles Metcalfe then read the paper printed above and a discussion followed.*)

Sir FRANCIS FOX: It is with pleasure I take this opportunity of saying that it is now something like forty years since Sir Charles Metcalfe, Sir Douglas Fox, and I first began work together, and we have been working together ever since. We engineers generally have to select the route of our railways by sending a theodolite party with levels over the country through which the line is to pass, but Sir Charles has a peculiar faculty about him, and can do this by walking or riding over the district. He thinks nothing of starting off on a walk of from 200 to 300 miles, and he invariably proves to have chosen the right route.

There is one other thing I should like to mention in connection with Africa.

If we look back to the time when we were boys at school we remember the map of this continent was wholly unoccupied in the interior; there were simply pictures of elephants and ostriches, and the Mountains of the Moon. Yet if we go back to the year 1666 there were then very fairly accurate maps prepared by the Portuguese and published in Amsterdam, on which the White and Blue Niles and the great lakes are shown. The Congo is also traced and its name given. Many of the great features of the interior of Africa were known in those days, and afterwards, for some reason, expunged from our later maps. I called Sir Henry Stanley's attention to this fact in Cape Town and said I thought he should go to the Houses of Parliament there and ask to see the map which is in those buildings. He went, and on his return he said if he had been aware of the existence of that map it would have saved many of the lives of his expedition on the Congo. I think this very able paper just read by Sir Charles is most interesting and valuable, as it shows what has been done and what still remains to be done to open up Africa to the traffic of the world.

Sir OWEN PHILIPPS: Sir Charles Metcalfe has left his mark on Africa, and will always be known as one of that small band who opened up Africa to their fellow-countrymen, and it is a satisfaction to all of us to know that that work of developing Africa by means of railways has been so ably and energetically carried on by General Botha's Government since the Union was formed. Nothing, if I may say so, since our Lecturer alluded to it to-night, has been finer in the building of railways in Africa than the work that was done by the Hon. Mr. Burton, the Union Minister of Railways and Harbours, and Colonel Hoy, the General Manager, when they coupled up the railways of the Union with German South-West Africa. I was told an interesting fact in connection with that work. The Germans, in their endeavour to hinder the advance of the British, went to a great deal of trouble in removing the rails as they retired; it was that very fact that facilitated the advance of the forces under General Botha, because the German gauge was a very narrow one and the lines had to be lifted before they could be set down at the broader gauge of the Union railways; therefore the work done by the Germans to stop our advance actually facilitated the operations in German South-West Africa. We have all listened with great pleasure to Sir Charles Metcalfe's interesting paper, and I only hope he may live to see the time, and help in hastening its arrival, when it may be possible to travel by railways from north to south and from east to west through what was once called the "Dark Continent."

Mr. OTTO BEIT: It is twenty-five years since I went to Africa first, and when I look back upon the work that has been done in the very short time since the occupation of South Africa it seems that it might have been centuries. So much has been crowded into South Africa, but so much always had to be done; one thing came on top of another. Was it diamonds? Was it coal? Was it the development of agriculture? One thing brought on the other, and the development of railways, such as we have seen and Sir Charles has explained to us to-night, was a necessity without which all this could never have been done. I think the explanation Sir Charles has given us will show what possibilities there are still, and the necessity there is for help in every way. The engineer, the man of business, the agriculturist, all have to do their share to bring out the wealth of South Africa. I think the old saying still comes true, "Out of Africa always something new."

Sir FRANCIS YOUNGHUSBAND: In the year 1895 I had the very great pleasure of making Sir Charles Metcalfe's acquaintance while I was stopping with Mr. Cecil Rhodes at Salisbury. I remember Sir Charles showing me the

tracing of a line which he was building from Beira up to Fort Salisbury. It was given in some detail up to within 80 miles of Fort Salisbury, and then I noticed that the line was very straight, so I remarked that he was lucky to have a straight run of about 80 miles into Salisbury. Well, he said, the fact is we have not been able to survey it in any very great detail—and I suppose that part was what he had done on foot, as Sir Francis Fox described. I was struck, coming from India, by the enterprising way in which they went about constructing their railways in South Africa. In India we take a very great deal of trouble and many years of work in surveying with great accuracy and making extremely intricate estimates of the cost of a railway, with the result that it is not for many years that it is actually constructed. But in South Africa they had evidently determined that it was important to get a railway into the country somehow in order to get into those very rough parts. If they came to a river they did not wait to take a lot of time to build a bridge. As long as they could get across the river during eight or nine months they did not bother about the remaining three months. As a result they got those railways up to Bulawayo and from Beira up to Fort Salisbury several years in advance of what we should have done in India, with very great benefit to South Africa.

Mr. WILSON FOX: I was tempted this evening in the middle of the lecture to wish that we might hear less about railways and more about Sir Charles Metcalfe, because the glimpses which he gave us of the adventurous career which he has had in Africa made one hunger for more. I greatly hope that that book which it was suggested to him to write three weeks after his arrival in Africa will be written now after experiences that have extended over so many eventful years. To Mr. Beit and myself the whirl of events which we have witnessed in South Africa has been extraordinary, and I think that, as Sir Charles Metcalfe has shown you, the rapidity with which railways have been constructed throughout the vast extent of Africa is one of the more remarkable features of a most remarkable continent. The network of railways you see through that continent has been largely due to the work of Rhodes, Beit, and Metcalfe. To make those railways possible you wanted two things—population to stop at the places to which they were built, and the people who could imagine the places to which the railways would be extended. When I was with Sir Charles Metcalfe on the Kafue some two years ago, and had been talking to him of the future for about an hour, my mind was filled with visions of wonderful stern-wheelers plying on the river, of hydropathic establishments all along its banks, and of its becoming the principal health resort of the world. It is that sort of imaginative looking ahead which makes a new country, and I wish that on another occasion Sir Charles Metcalfe would address a meeting like this and would give free play to that wonderful imagination he possesses. We are all very grateful to the lecturer for this serious and it seems to me extremely useful lecture.

Captain SLACK: There is perhaps one railway line that Sir Charles Metcalfe has omitted to mention, and that is the one between Durban and Cape Town. I think between the connecting points there are between 50 and 100 miles. It remains year after year, but no further extension seems to be made. Perhaps Sir Charles Metcalfe can tell us something about that.

Sir CHARLES METCALFE: I did not mention that line because I was not dealing with all the small local lines throughout those countries which make the Union. There is still a section, from Maclear to Kokstad, which has to be made to complete the railway joining up Cape Colony with Natal. I cannot say why this section has not yet been made. We were the engineers of the

first portion of this railway, viz. from Sterkstroom to Indwe, and I know Griqualand East fairly well, and it is a wonderful agricultural country.

Mr. J. B. THORNHILL: It is late, and so I will only keep you a few minutes. The destruction of slavery paralyzed the whole of the interior trade of Africa, for slavery as the native (not the European) conducted it in the past was Africa's banking and transport system. Railways are supplying transport, and it seems to me that the railway builders in order to secure freights for their railways should develop an extensive banking system as well, and work hand-in-hand with local and pioneer effort and finance the growing of rubber, maize, cotton, and tobacco. This would mean development within the Empire, which will be very badly needed in order to enable us to recuperate after the war. Another point I want to bring forward is the economic value of watersheds south of the equator. The Vaal-Limpopo watershed has settled up well. The Limpopo-Zambezi watershed is slowly settling up. The marvellous Congo-Zambezi watershed—1700 miles long, traversing Africa from east to west—appears to offer an ideal home for a white race. It seems to me that the first trans-African railway should follow this route from Lobito Bay to a port in what is now German East Africa. Finally, the carrying up the Rhodesian railway system from the Congo border to the south end of Lake Tanganyika—350 miles—is imperative in view of the impending operations for the conquest of German East Africa, which offers us a richer reward than any other German colony.

The PRESIDENT: Unless there is any other Fellow present who wishes to address the Meeting I would suggest the hour has come at which it is the duty of the President to say it is late, and to wind up the proceedings. Our lecture to-night has been, you will agree, most instructive and full of romantic suggestions. In Europe our railways are such everyday matter-of-fact incidents in our life that we do not look on them with any particular enthusiasm; but in any of the three great continents, Africa, Asia, or North and South America, a railway takes on a different aspect. It becomes a thing of romance. We see its branches in the form of great fingers indicating in what direction the firm hand of civilization and commerce will soon follow. I do not know that there is any sight that is more moving, more exciting in some ways, than to watch one of the great Trans-Continental expresses lumbering and thundering across the steppe of Siberia or the skirts of the Kalahari desert. Perhaps the moment when it is most exciting is when you, the traveller, have just been dropped at some wayside station, and see civilization departing from you, and your future progress depending on a Russian telega or a Cape ox-waggon. It seems to me we are in this Society, at any rate I feel myself, disposed to look upon railways too much from the travellers' point of view; to calculate in what time they will enable an inhabitant of London to go from Cairo to Cape Town. That point of view was very much emphasized by a late member of our Council, a very eminent man of science, Mr. Francis Galton. In the intervals when he was not engaged in the study of Eugenics he used to amuse himself by making maps showing the distances in time of the different parts of the globe from London. The great difficulty he had was that the British engineer worked so fast that before the map left the printer's hands it was already obsolete. Do not let us think that the principal object of the railways, made or projected, we have been shown on the map to-night is to take tourists to the ends of the Earth. Their first object will be to develop the continent which they penetrate. They will give to each coast a "hinterland;" they will bring down the goods and traffic from the interior to the sea-coast towns. They will never, of course, supersede ocean traffic, but

they will develop the whole continent by carrying civilization into the interior, creating new industries, tapping markets for European goods, and bringing down all sorts of tropical products to the ports. I do not think we could have had the progress that has been made more accurately or more fully described, or the hopes of the future more clearly sketched out, than they have been to-night in the admirable paper of my old friend Sir Charles Metcalfe, and I am sure you will wish me to endorse on your behalf the vote of thanks to him which has been already proposed and seconded. We shall all look forward to reading at our leisure in the *Journal* the detailed sketch he has given us, of the future railway development of what will no longer be the Dark Continent.

THE KIVU COUNTRY.

Sir Alfred Sharpe, K.C.M.G., C.B.

IN 1912–13 I made a journey in Africa together with the Hon. Mountstuart Elphinstone, in the course of which we visited some of the little-known districts lying west of Lake Kivu, and while at the north end of that lake were fortunate enough to witness a violent eruption in the volcanic region lying between the lake and the Ruchuru River.

Our journey began at Beira in Portuguese East Africa, whence we went by rail through Southern and Northern Rhodesia to Elizabethville in Katanga. We then returned in the same manner to Beira, whence we travelled overland to the Zambezi River, and through Nyasaland to the north end of Lake Nyasa and on to Lake Tanganyika. We were taken up the last-named lake to Ujiji by a small German Government steamer, which at that time used to make the round of the various German lake ports about once a month. Considerable interest attaches to Ujiji at the present moment, as it is the central station of the Germans not only for Lake Tanganyika but for a great deal of the western half of German East Africa. As the Germans are in undisputed possession of the railway from Dar-es-Salam to Ujiji this no doubt enables them to quickly move their troops, munitions and stores to any point between the sea-coast and Ujiji; and as on Lake Tanganyika itself they have "command of the seas" they are in a position by means of their steamers to carry out rapid communication with the station of Bismarckburg at the south end of Tanganyika, their base for operations against Nyasaland and Northern Rhodesia.

On the western shore of Tanganyika (Belgian Congo) there is high-lying country between 6000 and 8000 feet above sea-level, with very little bush, mostly open grass. The lake itself is extremely beautiful; the water is more of a dark green colour than blue (the colour of Lake Nyasa), but otherwise the two lakes, in general characteristics, are very similar. On the eastern shore of the lake there are a fair number of good harbours. Perhaps the best of these is Kirando, a picturesquely situated settlement, with excellent anchorage entirely protected by outlying islands. The

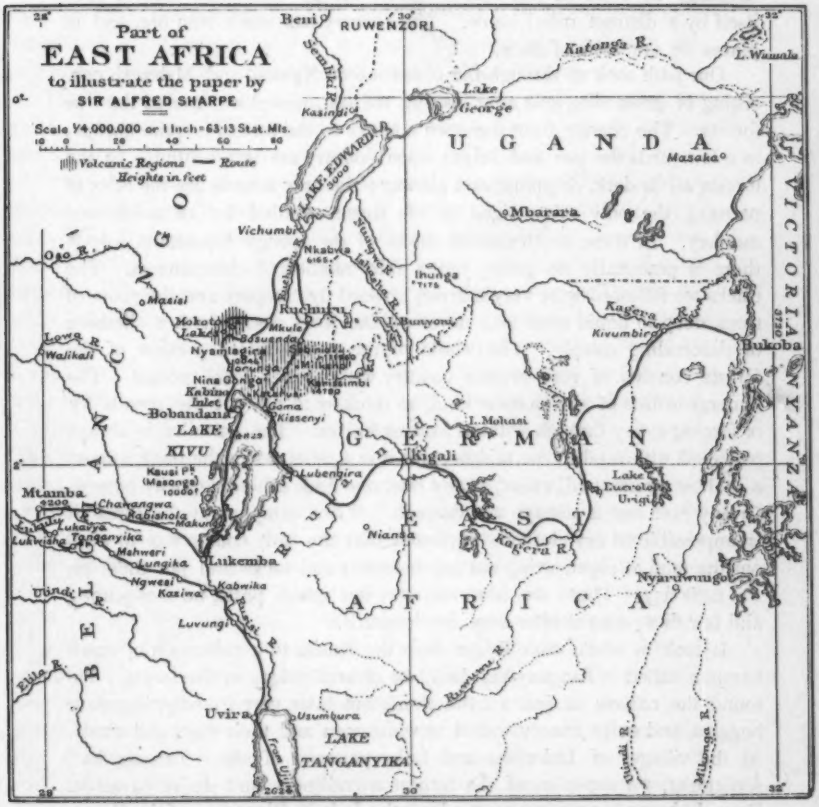
station has substantial buildings, and there is a large mission station and a sleeping sickness segregation hospital. A great part of the eastern shore of Lake Tanganyika has been more or less cleared of undergrowth for a width of 100 yards or thereabouts, with a view to getting rid of the tsetse fly and thus preventing sleeping sickness infection. The methods adopted with this object in German East Africa are somewhat different from those in British East Africa. In the former the chief efforts have been as far as possible to eradicate *Glossina morsitans*. In Uganda it is considered advisable to devote most attention to removing the entire native population from ground infested by this insect. Both systems have been more or less successful, though both have their limitations.

With the exception of comparatively small areas of more or less flat country the whole of the shores of Tanganyika both east and west are mountainous, and on the eastern shores often fall abruptly to the water, which is deep close up to the rocks. There are few outlying dangers and navigation is simple. Up to the present no commercial transport companies have run steamers on Tanganyika, the only ones in existence being those owned by the German and Congolese Governments. It was the intention of the German Government, immediately after the completion of the Dar-es-Salam–Ujiji railway, to construct two large steamers of 1000 tons each for use on the lake, and either one or both of these are probably now running. At the time of our visit the Germans were looking forward to great trade expansion in Tanganyika regions. Their opinion, gathered from our own experience in Uganda and East Africa, was that as soon as a railway in Africa from the coast reaches any one of the great lakes trade is bound immediately to increase to great proportions.

Ujiji at the time of our visit had a population of some 25,000 natives. It is now, as it always has been, a sort of miniature Zanzibar, and most of the people living there either come from the Zanzibar coast or are the descendants of Swahili people who followed British and Arab travellers and traders years ago. The terminus of the railway is not at Ujiji itself, as the anchorage is a poor one: it has been taken to Kigoma, an excellent harbour four miles north of the town, and the question as to whether the station at Ujiji will be eventually moved to Kigoma was not finally settled.

From Ujiji to the north end of Tanganyika is only ten hours' run by water, that is, to the German station of Usumbura, from which place a seventy-mile length of railway could easily be constructed to the south end of Lake Kivu, a line which would tap the vast cattle districts surrounding this lake. From Ujiji we ran to Uvira, the Congolese station at the north end of Tanganyika, and from there made our way up the valley of the Rusisi to the station of Luvungi, about halfway between Lakes Tanganyika and Kivu. This is a main road used by the Belgians for travelling from Tanganyika up to the Albert Lake by way of Lakes Kivu and Edward. Carriers can be obtained at fixed charges per day or per stage, but even on the main road it is almost impossible to obtain men who will go for more

than two or three days' journey. At Luvungi, after considerable delay, we succeeded in obtaining 60 or 70 carriers who undertook to travel to the north-west as far as the commencement of the true Congo equatorial forests. It is no easy matter to take an expedition west of the Rusisi valley; the country is so mountainous and broken that no fixed direction can be followed. The only possible course is to follow such tracks as there are and to stick as much as possible to the mountain ridges. From



Luvungi to the foot of the mountains which close in the Rusisi valley on the west is a distance of about 8 miles. The intervening plain is very rich and full of native cattle, with hamlets scattered all over it. The mountains are bare of trees and are fed over by cattle, sheep, and goats, even on the steepest slopes. The climb commenced abruptly, and following a leading ridge we rose at once for 2000 feet; then came a succession of ups and downs, mostly the former, till at mid-day we were 7300 feet above

sea-level, that is some 4000 feet above the Rusisi plain. The scenery is very grand; the hills are covered throughout with grass except on the higher peaks which have small patches of forest mingled with open bracken. The peaks reach to 9000 feet and over. Throughout the country there are mountain hamlets, immense groves of bananas and plantains, gardens of beans and cassava, and vast quantities of live-stock. The hill people are much the same in appearance and speak the same language as those in the Rusisi valley, though each little district calls itself by a distinct tribal name. The country has much iron ore, and in places we saw reefs of shale.

Our path took us through the countries of Ngwesi and Mshweri, consisting of grass hills, and after leaving the last named we entered the true forests. The change from the open country to the forests is quite abrupt: in a few yards the sun and bright open country are left behind. In the forests all is dark, dripping, and gloomy: the only sounds are the cries of parrots; the only other signs of life those afforded by an occasional monkey. In these south-eastern limits of the Congo Equatorial forests there is practically no game, but a fair number of chimpanzees. The tracks we followed were very narrow, crossed by creepers and the roots of trees, deep in liquid mud and never on the level, always either climbing or descending steeply. The whole of the south-eastern portion of the forests consists of very broken country without any level ground. The undergrowth is of the densest kind, so thick as to prevent the possibility of forcing a way through without axes or knives. The traveller is always plastered with mud to the middle, and it is a relief when the track follows a shallow stream bed, where, at any rate, one finds a hard, gravelly bottom. In any case one is always wet through. When camping in the forest it is impossible to dry clothes: we found that the only course was to wash out the mud at night, wring out our breeches and socks and put them on wet next day. There are, however, very few insect pests, no mosquitoes, and few flies; also neither lions nor leopards.

It took us seven days to get from the Rusisi to a collection of small hamlets called "Tanganyika," built on cleared ridges in the forest. We found the natives at first a little timid, but later very friendly, incessant beggars, and quite unaccustomed to white men and their ways and wants. At the villages of Lukwisha and Lukavya, west of the "Tanganyika" settlement, we experienced the utmost friendliness and desire to assist. From Lukavya we made our way down the Lukulu River, one of the Congo affluents. The difficulties, however, in moving at all in these thick forests, and the depth of the water in the streams and rivers at the time of our visit, prevented our prolonging any attempt to get further west than the 28th degree of longitude. It was, moreover, almost impossible to procure food.

From the Lukulu River we managed to get carriers to take us north through the forests to the hamlets of a Waregga headman called Mtamba. It was a marvel to us how the porters could carry our loads over the awful

ground we had to traverse up and down the forest mountains. They do not carry on the head or shoulder as in most parts of Africa, but sling the load on the back with a band of plaited grass round the forehead. The women have deep baskets with a flat side to lay on the back, and the usual forehead band. When going uphill the body is much bent forward, so that almost the whole weight of the load is on the back, and they carry long staffs which are always in use when descending the steep hill-sides. Many of the porters are women, who carry just as well as the men and seem to enjoy the excitement of a short journey. In addition to their loads there is generally a baby on the top. We paid our carriers in salt, calico, or Belgian coin. Salt especially was in great demand.

The forest natives, and in fact all the people north of Tanganyika, are great pipe smokers. Their pipes are carried with them wherever they go and at every halt are brought out and lighted. The bowls are made either of carved wood or of burnt clay, and the stems are reeds. The tobacco is grown locally and is the usual type of native-grown, imperfectly cured leaf. The Waregga forest people are lighter coloured than those in the Rusisi Valley, and are as yet unspoilt—happy and friendly, but great beggars. They wear scarcely any clothing; a brass or iron belt round the waist, sometimes a string of beads, occasionally a narrow strip of calico. The girls go naked until they are ten or twelve years old, and then wear a strip of calico, bark cloth, or plantain fibre. Men, women, and children wear beads and cowrie shells, according to their means of procuring them. Copper, brass, and iron bangles and leg-rings are also much in demand. The young girls are not bad looking but soon age and become worn and ugly; when elderly they develop prominent stomachs, with a pronounced inward bend of the backbone and a corresponding outward bend of the buttocks. The headmen were very friendly and were fond of leading us about by the hand. They are very noisy talkers and jabber at the top of their voice all day long. The small children are not shy; they soon make friendly advances, and if taken notice of become rather a nuisance. The men often wear close-fitting caps made of monkey-skin. At Lukavya's we dressed some sores on a native's leg, and after that our camps gradually became dispensaries. Scores of natives came to us with the most varied complaints, and this became such a tax on our time and medical resources that at length we devised a scheme under which any one wanting such medical treatment as we could give was required to bring in something in the shape of a food offering—bananas and plantain flour for our gun boys and servants. This system worked well; it reduced the number of applicants and replenished our often scanty larder.

The houses of the forest of Waregga are peculiar—long oval erections, in shape not unlike a large boat turned upside down; they have an opening at each end. The small hamlets being invariably placed on cleared ridges or hilltops, we found it difficult to get enough fairly level ground on which to pitch a tent.

At Mtamba's hamlets, situated roughly in long. 28° E., lat. 2° 15′ S., at a height of 4200 feet above the sea-level, we had a delay of several days owing to our being unable to procure sufficient porters to carry our loads. We at length got away on December 6, our course being about due east for Kivu Lake. Owing to the incessant rain and the difficulty of procuring porters we had decided to abandon the attempt to travel north through the forests. The forests are full of rubber (Landolphia vines): natives collect a little, which they sell to one or two Arab traders who periodically find their way to the small scattered villages. They might collect large quantities but have not much energy; work of any kind is not in their line. In the forests are also many beautiful flowers—orchids, creepers, immense lilies, and flowering bushes and trees; we saw one tree which was a mass of magenta blossom; we also noted wild coffee.

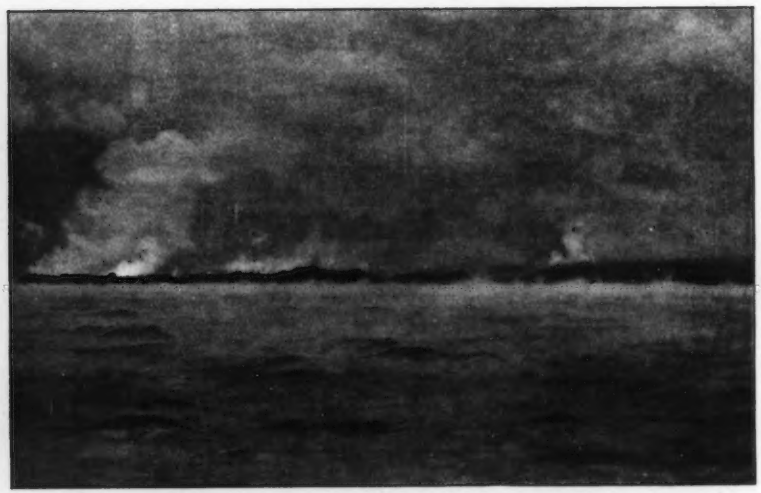
Two very hard days' journey from Mtamba's took us out of the forests to open country, and we revelled once more in the sunshine and extended views. It was a great relief to leave the depressing gloom of the dark forests behind, and the transition from the deep gloom to the bright sunshine of the clear open grass country is very sudden. These open grass lands west of Lake Kivu lie at an elevation of 5500 to 9000 feet above the sea, and on our journey east to the shores of Lake Kivu we saw peaks reaching to considerably over 10,000 feet. The grass is short and sweet and the country full of cattle.

On the night of December 9, when camped at a native village we noticed a dull red glare in the sky to the north-east, and as there was no dry grass in this country which could be burning, we concluded that it must be native huts on fire. The following night, however, when 15 miles nearer to Lake Kivu, we again saw this red light in the sky, but stronger than before. Laying out the compass bearing on our maps, we saw that it must be at the north end of Kivu, and as we knew that it was not many years since there was an eruption in the volcanic region lying immediately north of the lake, we concluded that there must be another outbreak. On December 10 we crossed the watershed between the Congo and Lake Kivu, the greatest height in our path being between 8000 and 9000 feet. From the rocky pass through which our path took us we gradually descended through magnificent country with a delightful climate and rich soil, teeming with cattle, sheep, and goats. Beneath us, apparently close but actually two days' journey away, lay Lake Kivu. This district is free from most African plagues, no lions, leopards, crocodiles, hippos, hyenas, jackals, tsetse fly or mosquitoes. We finally reached the Belgian post of Lukemba at the south end of Lake Kivu on December 11, and learnt that there was a big eruption proceeding at the north end of the lake. At night we could see the deep red glow 60 miles away, and by day there were dense black clouds to the north. We went up Lake Kivu from the south to the north-west corner in an iron boat kindly placed at our disposal by the Belgian officials, and arrived at the station of Bobandana,

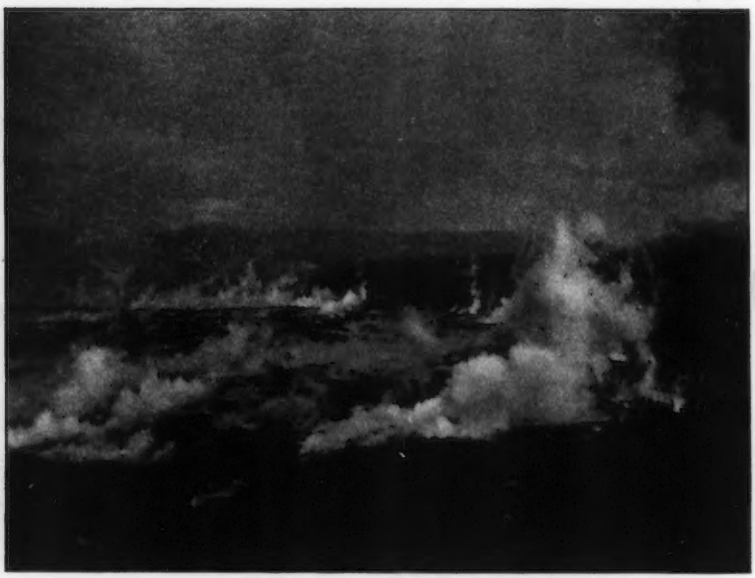
VOLCANIC ERUPTION AT NORTH EN

ORTH END OF LAKE KIVU. DECEMBER 1912.

From negatives by the Hon. M. W. Elphinstone.



NORTH-WEST CORNER OF LAKE, ALMOST BOILING.



LAVA FILLING KABINO INLET, LAKE KIVU.

From negatives by the Hon. M. W. Elphinstone.

7 miles from the erupting volcano, on December 19. Here we had a splendid view of the eruption which had then been in progress for eleven days. Lake Kivu lies at the highest point in the great rift depression which runs from the south end of Lake Nyasa to the north end of Lake Albert. The level of Kivu itself is almost exactly 5000 feet, the mountains east and west of the rift rising to 10,000 feet and over. The floor of the rift at this point is crossed by the volcanic belt generally known as the Mufumbiro Mountains, imagined by some to be the ancient "Mountains of the Moon," which were supposed to be at the sources of the Nile. Certainly the very ultimate sources of the Nile rise at the bases of the great Mufumbiro volcanoes. The Ruchuru takes its rise near the base of the Karissimbi volcano (whose peak is frequently covered with snow), and flowing through Lake Edward continues north as the Semliki River to Lake Albert. The Kagera, the eastern ultimate source of the Nile, also has some of its sources near the base of Sabinio (11,960 feet), and running by a tortuous course to the Victoria Nyanza, leaves that lake by way of the Ripon Falls and becomes the Victoria Nile.

The highest peaks amongst the Mufumbiro volcanoes are detailed with their heights by Captain Jack, R.E., in a paper which appeared in the *Geographical Journal* of June 1913. In addition, however, to the larger peaks the whole of the floor of the rift north of Lake Kivu is dotted over by volcanic cones of all sizes. The only volcanoes active at the time of our visit were the newly opened one which was in eruption, and which had been christened by the Belgian officials "Katarusi" (the name of a native village close to the spot where the eruption took place), and Nyamlagira (10,046 feet), which was throwing out vast volumes of black smoke from its enormous crater, with occasional showers of mud.

At Bobandana we learnt that the new volcano, which had already built up for itself a cone about 600 feet in height with a crater some 600 yards in diameter, was an entirely new one. Its site was perfectly flat ground covered with grass and stunted trees growing on an ancient field of lava which had probably flowed from Nyamlagira. The eruption began with an earthquake, and immediately afterwards smoke was seen issuing from great rents in the ground. This was followed by fire and explosions, and twenty-four hours later a full-fledged crater was pouring out a column of fire, ash, and lava. Every day the eruption increased in violence, and at the time of our arrival was a magnificent sight. A broad river of swiftly flowing lava poured into the Kabino inlet at the north-west corner of Lake Kivu, 3 miles from the volcano, and had already heated the water at that part of the lake to boiling point. Dense volumes of steam rose from the lake and mingled aloft with the thick black cloud of smoke which hung over the whole country west of the volcano. The direction of the prevailing wind, especially in the upper air currents, was due east, all the ash, falling stones, and smoke being carried westward. The stations of Bobandana (south)

and Goma and Kissenye (east) did not suffer. We were hospitably received at Bobandana by M. Henri, an officer of the Belgian army in charge of the district north-west of Kivu, and went with him on December 20 in canoes across the corner of the lake and as near to the volcano as we could safely get. Our crossing was about a mile in width, the water being too hot to bear our hands in it, and we were half suffocated by dense clouds of steam and fumes. We found that a large bay, forming the northern extremity of the Kabino inlet, had already been filled with lava, and natives were fleeing from the country near to the volcano, their villages and crops having already been destroyed. We were told that the previous day a canoe-load of natives, crossing the north-west arm of the lake, were overcome by steam and fumes and died in their canoe, which was eventually carried into boiling water and sank. On the return journey we were careful to keep as far out in the lake as we could in order to be clear of the most steamy parts. Occasionally whirlwinds of steam would form and stretch upwards for 300 feet or 400 feet like waterspouts. What with the roar of the volcano, occasional deafening explosions, the vast volumes of steam and smoke, and the lurid gloom all round, it was a striking scene.

On December 21 I had to go to the Belgian station at Goma, on the north shore of Kivu, to buy at a German store various things we had run out of. In order to reach Goma I had again to cross the north-west corner of Kivu by canoe, but intended to keep far out in the lake in order to avoid the boiling water. Unfortunately a strong south-east wind arose when we were halfway across, and the sea which got up was too much for our canoe, and forced us to run up into the hot water to avoid being swamped. It seemed at one time as if we were to have a choice of being swamped and boiled or suffocated, but we succeeded in making the northern shore, all of us wet through with perspiration and steam, the heat being intense. The whole of the water at the north end of Kivu was hot by this time, and many thousand fish were floating dead; it was only near to the exit of the water from the Kabino inlet into the main body of the lake that it was boiling. On the return journey the following day I waited for perfect calm and managed better, but it would have taken a great deal to induce me ever to make such a voyage again.

On December 22 the top of the Karissimbi peak was covered with snow. On the evening of that day a second stream of lava came from the volcano and made its way to Kivu, entering the lake about 1½ miles east of the Kabino inlet. Next day we started from Bobandana for the Mokoto Lakes, about 30 miles north-west of Kivu and 40 to 50 miles south-west of the Edward Nyanza. Our route lay around the Kabino inlet and west of the volcano; we camped that night at the southern end of the Kabino, 12 miles or more from the eruption, and even here the water was too hot to bathe in. On the following day, Christmas Eve, we had a hard journey and a terrible night. Kabino is bordered by high mountains and we had to follow its shores, and finally

to make our camp 6 miles west of the volcano. All the country along the shore of Kabino was buried in black ash, the crops were destroyed, banana trees fallen, native huts partly buried or crushed flat; the incessant rain coming from the black cloud overhead caused landslips which carried crops and houses into the lake. Our camp was in a small hamlet on the top of a peak, and the place was still inhabited, the reason given us by the natives being that they had nowhere else to go. For miles in every direction the country was black; there was not a green leaf or blade of grass to be seen. We found many birds and small mammals killed by falling stones, some of which measured 2 inches in diameter. We did not sleep that night: we had several sharp earthquake shocks, hurricanes of wind frequently occurred with appalling lightning, our tents were nearly blown away, and for two hours a heavy fall of ash and stones threatened to bury our small camp. The roar from the volcano was incessant—a steady, deafening roar—and the whole country below us was lit up by the column of fire, lava, and red-hot material, which was shot up many thousands of feet.

We were only too glad to get away at the first streak of dawn and to make our way as quickly as we could to the north-west. In order to make sure of finding drinking water on the ancient lava-field over which we had to pass we made for the slopes of the Nyamlagira volcano, which is clothed with dense forest, camping the first night at a hamlet due north of the eruption and about 10 miles from it, and the second night in the forests on Nyamlagira, where we were somewhat alarmed by a mud shower. Both on December 25 and 26 we had frequent earthquake shocks, and all day and night we could hear the roar of the eruption till we were 50 miles away.

Many hundreds of natives were killed, mostly owing to their refusal to leave their villages and seek shelter elsewhere. Many more would die from starvation as the crops were totally destroyed over a large extent of country west of the north end of Kivu. Some idea of the fierceness of this outbreak while it lasted may be gathered from the fact that at the post of Walikali, in the Congo forests 100 miles to the west, ashes fell heavily for two days, while the eruption was heard at Beni 140 miles to the north and at Bukoba on the Victoria Nyanza 190 miles east.

From the base of the Nyamlagira volcano we then crossed ancient lava-fields to the west till we reached the foot of the steep mountain slopes bordering the western side of the rift-valley. Travelling over lava is sometimes easy, sometimes awful; it depends on the character of the lava: some sets with a smooth top; there are occasional chasms, cracks, holes and wrinkles in it, but it is comparatively easy to walk on; at other times it is a jumbled mass of cinder lava and occasionally piled up in immense masses most difficult to find a way through. We had a fatiguing, though interesting march from Nyamlagira to the ranges. The level of the lava-field where we left it at the very foot of the mountains was 5900 feet above sea-level, and from there we had a steep climb of 1200 feet to the hamlet of Mkule. We were tramping this day from early dawn

to sunset, and our carriers were tired out, their feet much bruised and cut by the lava rocks.

The village, like all Warundi settlements, was perched on the top of a peak overlooking the rift-valley, and in the far distance we could see the gleam of the Edward Nyanza. The hill people here had little food except milk and bananas, and we found difficulty in procuring food for our natives. During the night at Mkule we had two pretty severe earthquake shocks. We had, however, become accustomed to these, as they occurred daily during the time we had been in the north Kivu district owing to the volcanic eruption and disturbances which were then taking place. On December 29 we reached the first of the Mokoto Lakes, travelling from Mkule through splendid country with rich volcanic soil and fairly populated; it was for the most part grassland, but without enough stock to keep the grass short, as was the case further south. In some parts this grass was very rank and tall, with stems almost as thick as sugar-cane. The hills were not so steep and broken as those we had previously traversed. All of this country has obviously suffered in previous times from Nyamlagira's eruptions, and there must have been great cinder falls not many years ago; these, however, are now helping to enrich the soil. The average level of the country was from 6000 to 7000 feet, and as the rains had broken we had fine, cold, sunny weather and thoroughly enjoyed our journey.

At Mokoto there are four small lakes, at an average of 5,800 feet, and as we approached them we again came to ancient lava-fields. This Mokoto field of volcanic action seems, so far as we could ascertain, to be entirely cut off from the Mufumbiro field, Mokoto Mountain being apparently a solitary volcano of a more ancient date than most of those to the south-east.

Leaving Mokoto and its beautiful lakes on 6 January 1913 we made our way towards the Edward Nyanza, retracing our outward track as far as Mkule and then descending to the rift-valley. In a new country it is often better to take a roundabout route which you know than to attempt a short cut through an unknown district, as it is impossible to gather trustworthy information from natives; in fact, in the Eastern Congo, as in many other parts of Africa, the usual policy on the part of the natives is to endeavour to put every obstacle in the way of a white traveller, and above all to deceive him on questions concerning the best paths and routes. From the point below Mkule, where we again reached the rift-valley (5900 feet), we followed it in its northerly direction, keeping close to the foothills so as to avoid lava as much as possible. As we went north we steadily descended, and were glad to leave damp and cold behind and to once more get into a genially warm climate. On the 8th we camped at 4000 feet, and found ourselves at last in a game country, mostly waterbuck, with bushbuck in the foothills. Our men were delighted to get meat again, especially the dozen boys we had brought with us throughout our journey from Nyasaland, who, being Mohammedans, had been unable to eat elephant meat.

RUSISI VALLEY FROM ABOVE GUVUMBI.

HIGH OPEN COUNTRY WEST OF RUSISI VALLEY.

From negatives by the Hon. M. W. Elphinstone.

M'TENGULA BAY, LAKE NYASA.

NORTHERN LAKE, MOKOTO.

From negatives by the Hon. M. W. Elphinstone.

We stopped short of the south end of Lake Edward, as we had heard that sleeping sickness was established there, and did not wish to lay our carriers open to infection. We did not expect to find *Glossina palpalis* (sleeping sickness tsetse) in the Ruchuru plains, but in this we were mistaken, as on entering the thick belt of scrubby bush which borders the Ruchuru River we found it thickly infested with this fly, which freely bit our carriers and ourselves during the crossing of the river. We crossed it at the northern limit of the lava-fields which is about 40 miles from the Nyamlagira volcano. Before reaching the Ruchuru we crossed a smaller river issuing from lava rocks, which forms a series of marshes on the western side of the rift-valley and enters the Edward Lake near to its south-west corner: none of the natives could put a name to this river. The Ruchuru plains near to the Edward Lake are full of game, with plenty of hippos in the pools and marshes. We had much trouble in crossing the Ruchuru which is a deep, swift-running river; it took us half a day's hard work and we felt we were lucky not to have lost any of our loads. We camped at 3600 feet near its banks and clear of the bush and tsetse (*Glossina palpalis* is never found in the open). On January 11 we reached the Ruchuru station, where we were hospitably received by the Belgian officers, who not only placed a house at our disposal but took much trouble to assist us in the continuation of our journey south to Goma, at the head of the Kivu Lake, whence we proposed to travel through German territory to the Victoria Nyanza. Throughout our travels in the Eastern Congo we experienced great kindness and hospitality from the Belgian officers and officials, who are doing the best they can to deal with the various difficult problems, native and otherwise, which face them in this out-of-the-way portion of the Congo colony, a country which has a great future.

Leaving Ruchuru station on January 12 we followed a good cleared path, or bridle track, to the Belgian station at Goma on Lake Kivu. We steadily rose to 6500 feet, camping the first day at Bosuenda, the second at Borunga, at each of which places there is a rest-house, with mud and wattle buildings. We found it always advisable, however, to pitch our tents in order to avoid jiggers, with which all these stations on the Tanganyika-Kivu-Edward road are infested. Each rest-house had a garden in which were quantities of strawberries, potatoes, and vegetables of various kinds, the garden attendant being the native in charge of the rest-house. The country passed through was charming, with a dense population and rich volcanic soil (till we descended to the Kivu lava-fields). On the higher portions every yard of ground is under cultivation. At Borunga we were among the big volcanoes once more, with Mikeno (14,540 feet) and Karissimbi (14,780 feet) east of us, and Nina Gongo (11,386 feet) to the west. In the dense forests covering the lower slopes of Nina Gongo there are a few elephants, whose tracks we saw crossing our road. We were told, however, that they only carry small tusks. It is not generally known that the true gorilla is also found in these forests. Several

specimens have recently been secured and sent to European museums. At Borunga we were within a short distance (10 or 15 miles) of Mount Sabinio, the big volcano (11,960 feet) which marks the point "where three empires meet"—British, German, and Belgian. This south-west corner of Uganda was described by Captain E. M. Jack, R.E., in the interesting paper entitled "The Mfumbiro Mountains" which he read before the Royal Geographical Society early in 1913. We found that the general name applied to a volcano in the North Kivu districts was "chirunga" (pronounced "kirunga" by coast natives, the plural form being "virunga").

After leaving Borunga we descended 1000 feet to the lava-fields, and the latter portion of our route to Goma was less interesting and not such good going. The whole of this North Kivu country is subject to periodical volcanic outbursts, and is from time to time desolated by lava and by cinder falls. The northern shore of the lake is formed entirely of lava rock; there are no beaches, and we were told that from the rocks in many places 100 fathoms of line can be let down before touching bottom. In addition to the larger volcanoes the whole country bordering on the north end of Kivu is dotted over with numberless old craters of all sizes. The boundary between German and Belgian spheres, which begins at Mount Sabinio, runs in a more or less south-westerly direction and strikes the north shore of the lake at a point between Goma (Belgian) and Kissenye (German), each of these stations being a frontier post. Goma stands on lava and has extinct volcano cones and craters close around it. Kissenye is situated just outside what may be called the "volcanic area," is not built on lava, possesses a sandy beach, and is backed by mountains (not volcanic). If a prophecy may be ventured, at some future time—it may be a thousand years hence, it may be to-morrow—the site of Goma will be destroyed by lava-flows and volcanic eruptions. Kissenye may possibly escape.

Kissenye, the German border station at the north-eastern corner of Lake Kivu, is well laid out and has good buildings, well-designed roads, and many trees and shrubs. At the time of our visit we were told that it was the intention of the German Government to make it an important trade centre for the Kivu districts. There are great possibilities for trade in this part of Central Africa; the great drawback being one of transport. So far the chief export has been hides, which go down in thousands by native carriers from Ruanda and the borders of Lake Kivu to the Victoria Lake, whence they proceed by lake steamer and railway to Mombasa. As soon as Lake Kivu is reached by a railway there should be immediate trade expansion. The climate in the countries surrounding Kivu is delightful, the scenery charming. There appears to be no malaria, and Europeans live in excellent health both on the lake-shore and in the hills. The lake itself reminds one of a highland loch. The southern and eastern shores are a mass of bays, fjords and islands of great beauty: it would be an ideal yachting ground. There are many fish in the lake and otters are numerous, but there are no crocodiles nor did we see any hippos. Canoes

are rather scarce, as they have to be cut in distant forests, but what there are are very fine ones, better "sea boats" than those used on Lakes Nyasa and Tanganyika.

We coasted down the eastern shore of Kivu in canoes to the port of Lubengira, a little south of the 2nd degree of south latitude. Hence we travelled overland by way of Kigili to Bukoba on the Victoria Lake, crossing the Kagera river twice. Immediately after leaving Lubengira we climbed to 7000 and 8000 feet above sea-level. The whole of this high country east of Kivu is similar to that lying west of the lake—open grass entirely free from forests, and either cultivated or fed over by numerous herds of cattle belonging to the Wa-Ruanda.

Ruanda is populated by two races, the Wa-tusi and the Wa-hutu. The former were at some long time past immigrants from the far north-east, possibly Abyssinia, Gallaland, or Somaliland. They are tall and spare, have good features, are fairly light coloured, and reminded us much of the Somali. They are the aristocracy. All cattle and other stock are considered to be their property, and they do practically no work. The Wa-hutu are the original inhabitants, conquered no doubt by the invading Wa-tusi: they are the serfs, the workers: they look after the stock, grow the crops, and do all that is done in Ruanda; yet they dare call scarcely anything their own. The Wa-tusi regard them as slaves, existing only to labour for their masters as herdsmen and tillers of the soil. At one time the Wa-tusi must have been a strong warlike race; they have now become effeminate and incurably lazy—if a Mtusi has to travel even a short distance, he is carried by a Mhutu. No longer of any account as a fighting race, the Wa-tusi have not much value in the country. To them, however, is probably due the credit for originally introducing cattle into this part of Central Africa, where they have so marvellously thriven. We were told that, according to a rough census taken in 1912, the number of cattle in the Ruanda district was estimated at two and a half million head. The total number of hides exported during the year was 240,000. It appeared to us probable that the relations hitherto existing between the Wa-tusi and Wa-hutu will require to be reconsidered, in order that the industrious Wa-hutu may be given a better position and a larger stake in their own country.

The Wa-tusi have kept their race very pure and have not intermarried with local people to such an extent as one would have expected. Wa-tusi women are kept much secluded; although we spent a week travelling across Ruanda, we never saw a young Mtusi woman.

All the western part of Ruanda is beautiful country. Above 7000 feet grass gives way to bracken in which are many blackberries. Streams of cool clear water are abundant. The weather during the time of our journey was perfect—a succession of English summer days, with gentle breezes, bright sun, and mild warmth. The nights were cold, three blankets being generally necessary. Our camps were pleasant ones,

attended by still bright evenings, with the sound of lowing cattle and bleating sheep and goats, and there was everywhere an air of peace and content. The greater part of Ruanda would be entirely suitable for settlement by Europeans. Throughout this country we were able to use our bicycles for a large part of each day's journey: this always makes things pleasanter and brings one into camp fresh and untired after a day's march. On reaching the south-eastern bend of the Kagera River we descended from the high pleasant regions in which we had spent so long a time, to a vast marshy valley which at some past period had been a lake. It is now a succession of lakes and papyrus swamps, through which wanders the course of the Kagera River. In fact, we here returned to tropical Africa under normal conditions.

On reaching Bukoba we went straight into European civilization. This place, which was recently more or less destroyed during an attack from British East Africa, was the principal administration and trading post on the eastern German shores of the Victoria Lake. It possesses fine streets, avenues, botanical gardens, and houses which are in no way inferior to those in East African coast towns. It had a large and increasing export trade, not only in hides, ivory, rubber, etc., coming from the west, but in the produce of the district itself, consisting of large quantities of coffee and oil nuts, grown entirely by local natives. From the Victoria Nyanza we returned home by the usual routes.

SIR ALLEN YOUNG.

THERE has passed away from among us one of the very last of the searchers for Franklin, and one of the best. Sir Allen Young was a great sailor, an accurate navigator, and a commander beloved by all who ever served under him; modest to a fault, and disliking publicity.

Born on 12 December 1827, Allen Young left his home at Twickenham and entered the sea service at an early age in 1842. Young's rise was rapid and due undoubtedly to his own merits, although he was not without interest. In 1853–54 he was commanding the *Marlborough*, a fine Indiaman. He took her twice round the world, and brought home Governor Eyre, for whom he had a profound admiration. It was great promotion to the *Adelaide* troopship, 3000 tons, during the Crimean War.

When McClintock was fitting out the *Fox* for the final Franklin search in May 1857 Allen Young was keenly interested. He went to Lady Franklin to volunteer, and she was satisfied from reports she received that he was active, energetic, full of zeal for the cause and a thorough seaman. He was appointed Master of the *Fox*, but he declined all remuneration. He gave £500 towards the expenses of the expedition. In the same year he was elected a Fellow of the Society. On 26 June

1857 the officers of the *Fox* all dined with Lady Franklin, and on July 1 the *Fox* sailed on her perilous and most important quest.

During the terrible voyage that followed McClintock and Young came to know each other well, and soon were fast friends. It was a trying time: held up by the ice in Melville Bay, drifting south in the clutches of the ice through the winter, encountering a gale at the edge of the pack, returning to their work without a moment's hesitation, exploring Bellot Strait, and finally settling down to a second winter in preparation for their great work in the spring.

Allen Young commenced his travelling by laying out a depôt in February, with the mercury solid all the time. He also made a ten days journey in March to Fury Beach for some stores, and was attacked by snow blindness.

On April 7 he began his journey of discovery. The work allotted to him was the completion of the coast of the great Prince of Wales Island—that of its southern half—and of the west coast of North Somerset. His party consisted of the old veteran Harvey, three other men, and a team of dogs with Samuel, the Eskimo, to drive them.

In two days the party crossed the Franklin Channel and, landing on Prince of Wales Island, Young named the cape on which he first set foot after his friend Governor Eyre.

The coast, as they advanced, was low and desolate in the extreme. On April 19 they rounded the southern point of the island. The coast went much further south than there was reason to anticipate, so that Allen Young had not sufficient provisions to reach the point of junction with the furthest point discovered to the north, with all his men. So he sent back all except one named Hobday to Cape Eyre, with the sledge in charge of old Harvey. Young and Hobday went on. Untrained in the building of a snow hut for passing the night, they merely dug a ditch in the snow just big enough to hold two. The two dauntless explorers advanced until, on May 7, they reached the table-topped hills seen by Sherard Osborn in 1851. Then, having completed the discovery on the west side, Young determined to make an attempt to cross the ice to Victoria Island. But it was impossible. The course was amongst tremendous ice hummocks with deep fissures into which the sledge constantly fell and was almost buried. After two and a half marches he had only progressed 15 miles, so he reluctantly gave up the attempt, making the best of his way to Cape Eyre, where he found the rest of his men encamped.

Excellent exploring work had been achieved. The discovery of Prince of Wales Island had been completed, and the character of the ice in McClintock Channel had been ascertained—a discovery of very great geographical importance. Allen Young and the seaman Hobday had travelled together for forty days. During this journey the two explorers were in extreme danger from starvation. They were saved by the shooting of a bear.

Allen Young was obliged to return to the ship for medical treatment, but he started again on June 10, in spite of the doctor's remonstrances, to finish the work by connecting Cape Eyre with the furthest reached in 1851 by the sledge party from Captain Austin's Expedition on the east side. He completed the connection on June 20, and then crossed the channel to Sir James Ross's furthest in 1849, completing the discovery of the coast of North Somerset to Cape Bird. He took frequent observations for latitude, and for longitude both by chronometer and lunar distances. The party was nearly worn out by the long continuance of hardships, and in crossing the channel they had to drag while up to their thighs in water. McClintock, having completed his memorable journey, went out to meet them and bring them help. They had been away for eighty-two days.

The discoveries of McClintock and Young established the line of the North-West Passage. All other routes are blocked by permanent and impassable masses of ice.

McClintock's praise was worth having, but very sparingly given. Of Allen Young his chief said that he always felt the fullest confidence in his ability, energy and zeal, whether in charge of the ship or in conducting his independent line of discovery by sledge; "Nor," he added, "do I know of any instance of conduct so disinterested as yours, in embarking as you did in the recent Arctic expedition."

On the return of the *Fox* the whole nation was filled with admiration at the way in which a great and memorable success had been achieved. Allen Young gave his experiences in the first number of Thackeray's *Cornhill Magazine*.

It was not long before Allen Young's services were again sought for. He commanded the *Fox* in the North Atlantic Telegraph Expedition of 1862, going to the Færoe Islands, Iceland, and Greenland. Then he was selected by Sherard Osborn as one of the captains in the European Chinese navy, and was in command of the *Quantung* gunboat. He had become a lieutenant of the Royal Naval Reserve in February 1862, but he always preferred to call himself a master mariner. In 1871 he was Commissioner to the Maritime Congress at Naples. In 1875 he was again afloat as Commissioner to the National Aid Society, and was at Suakin during the operations there.

In those years Allen Young was frequently employed very usefully in the public service. His favourite relaxation was yachting. As a member of the Royal Yacht Squadron he passed much of his time at Cowes, where he had numerous friends and was very popular.

In our efforts to obtain the despatch of an Arctic Expedition from 1864 to 1876 Allen Young was most useful in various ways, gaining many converts to the cause. It was on 3 March 1873 that there was a large audience at 21 Eccleston Square to witness Allen Young's Arctic dissolving views, when Lady Franklin was present and a number of naval

officers, some of the old school contemporaries of Austin and Kellett, and some of the rising generation. It had an excellent effect, and from that time the agitation went steadily on until success was achieved and a Government expedition was despatched.

Allen Young in those days longed to be once more among the ice-floes. He determined to try the chance of passing through the North-West Passage. Franklin's year was a good year, McClintock's two years were bad years. There might be another good year. So he bought the *Pandora* from the Admiralty, a vessel built for speed, having had one commission on the West Coast of Africa 1863–67, commanded by Captain Ruxton and afterwards by Paddy Stubbs. Young had her well strengthened and equipped as an Arctic ship at Southampton. She carried the white ensign and burgee of the Royal Yacht Squadron.

Allen Young took as his officers Lieut. Lillingston, who contributed to the expenses, George Pirie, R.N., a smart clever young officer, and Koolemans Beynen from Holland, a thoroughly effective representative of the navy of Van Tromp. The crew consisted of twenty-seven all told, several being old shipmates in the *Fox*. Allen Young, as was his wont, did all he could to keep his cruise quite unnoticed, carefully avoiding all demonstrations, but without complete success, for the crews of H.M. ships gave the *Pandora* hearty cheers as she steamed away on 26 June 1875.

After a stormy voyage across the Atlantic the *Pandora* reached Ivigtut, on the coast of Greenland, where Young obtained material for one of the very few accounts of the cryolite mine,* and where he had the pleasure of seeing the old *Fox* again doing useful work for her new masters. Proceeding northward the *Pandora* arrived off the island of Disco for a supply of coals from the Kudliset coal cliffs. Young had asked the present writer, who went out in the *Alert* to return in the *Valorous*, to arrange with the Danish Inspector of North Greenland to have a supply of coal ready dug out of the cliff for the *Pandora*. This had been efficiently done, and Young found a bevy of very pretty Eskimo girls as coal-heavers, ready to take the coal on board. This saved much time, and by August 18 the *Pandora* had worked through the ice of Melville Bay and was off the Cary Islands. Passing down Barrow Strait with much difficulty and some danger, Beechey Island was visited.

The *Pandora* entered Peel Strait, but from the first the prospect of reaching the North American coast was not promising. Sure enough the ice was found to be fixed right across the strait, and there could be no passage in that year. One very useful piece of work was possible. Allen Young was able to revise the charting work he had done during his land journey in 1858. He was surprised at his own accuracy under such exceedingly difficult conditions as he encountered in 1859.

* Others in the *Edinburgh Philosophical Journal*, by Sir C. Geisecké, **6**, p. 14; in the *Quarterly Journal of the Geological Society*, **12**, p. 140; both reprinted in the *Arctic Manual*, pp. 341 and 344, also in Dr. Rink's 'Danish Greenland,' pp. 79 and 313.

A good seaman was needed to effect a return from the *Pandora's* advanced position. A gale was blowing and icefloes were drifting to the north. It was needful to pass or evade the drifting icefloes. Then quantities of ice began to come down from the north. Young's narrative is as simple and as clear as his conquest of no common difficulties was bold and resolute. His chief Sir Leopold McClintock looked upon him as perhaps the finest of living seamen. In returning Allen Young discovered and brought home a record of the proceedings of the Nares Expedition.

The *Pandora* returned to England and was laid up for the winter in Southampton Docks. Allen Young's intention was to sail early in June and make another attempt to navigate the coast of North America. He thought that the prevalence of north and north-westerly winds had made an exceptional block in Peel Channel, and that in another year it might be clear. So he resolved upon a second attempt.

Lieut. Arbuthnot, R.N., took Lillingston's place; Pirie and Koolemans Beynen joined again; Grant came as photographer, and an Austrian officer, Ritter von Becker, also joined.

But the carefully thought-out plans were upset. After many years of effort the Geographical Society had obtained the consent of the Prime Minister that a Government expedition should be despatched. The Society's objects were geographical discovery and scientific research, and it was considered that there must be communication with the advanced ship either through a depôt ship stationed within reach, or by the annual despatch of a vessel. But as soon as the matter was placed in the hands of the Board of Admiralty that body altered the objects into a rush to reach the pole, and refused to take any steps to secure the needful measures for annual communication. I wrote a pamphlet on the subject for the perusal of their lordships and other representations were made, but all to no purpose. At last they became alive to the fact that their conduct was unpopular, and they resolved to send a vessel. But it was much too late. There was no time to fit one out. So they asked Allen Young to abandon his plans and do their work for them. As he looked upon it as a public service he at once consented and placed himself and his ship at their disposal. The object was to open communications with the Nares Expedition, but the Admiralty wisely left all details to Allen Young. He however wrote a very able despatch reviewing the situation, and explaining his intentions with regard to the various difficulties that might arise.

The *Pandora* encountered a furious gale in the Atlantic, always a useful experience, as it enables things to shake down into their places. In Melville Bay the little vessel was severely nipped and in great danger, things looking so serious that her gallant captain made every preparation to abandon her. The conduct of Young's faithful servant Charles should be read in the original. The imminent danger in Melville Bay was

followed by a perfect hurricane in the North Water before the goal, the entrance to Smith Sound, could be reached. In facing such perils Allen Young was in his element.

There was a remarkable example of Young's resolution during the present voyage. He had made for Cape Isabella to ascertain whether Captain Nares had left a record there. A party was sent on shore to land the post for the exploring ships and brought off a letter left by Captain Nares, in which it was stated that despatches would be deposited in a cask. A cask was seen but not opened because it was supposed that it contained provisions. Young had been on deck for twenty-nine hours. He did not even then go below to sleep, but to think, and he came to the conclusion that the cask must be examined. He resolved to return to Cape Isabella. A gale sprang up in the night and there was such a sea that a boat could not be lowered. This business showed the main point in Young's character. He would not be beaten. Cape Isabella seemed to say that he should not land again. Young replied that he would. He was driven off by wind and sea and ice. Day after day he continued to struggle against the elements—wind and ice and fog—to reach the cape. Several times he was within a few miles, but it was impossible for a boat to live among the heaving masses of ice. He forced the ship through such ice as he had never before seen. At last he was driven right across the channel by a great icefloe. For three weeks the *Pandora* had endured a fierce battering from the ice, and was much knocked about. Again Young began the struggle with ice, wind and fog. Such indomitable resolution must win in the end, and of course it did. A boat landed and examined the cask. It was empty.

The Nares Expedition returned after the first winter, so that there was nothing left for Young to do, yet he remained in Smith Sound until the ice drove him out. On October 16 the *Pandora* sighted the *Alert* and *Discovery* in the Atlantic. Captain Nares was very anxious to arrive in England first with his news and to tell his story, and he told Allen Young very little by signal. He did not know his man. Young at once shortened sail and arranged so as to arrive at least three days after Nares. When the *Pandora* did arrive Young kept his proceedings as much in the background as possible. Of all things he detested publicity and self-advertising.

Allen Young had kept an excellent journal, and he was induced to write a narrative of the two voyages for private circulation. It was with the greatest difficulty that he was at last induced to publish it. I supplied a few explanatory notes and corrected the proofs. I consider the 'Two Voyages of the *Pandora*' (Stanford, 1879) to be a perfect model of the way in which an Arctic story should be written. It is clearly and pleasantly told, with many interesting remarks on scenery, weather, navigation, and natural history; and there are touches here and there which, unintentionally, show the fine character of the author.

He retained a warm feeling of affection for young Pirie, and for his enthusiastic Dutch officer Koolemans Beynen. Between the *Pandora's* two voyages Koolemans Beynen, with much ability and abundant research, edited the three voyages of Barents for the Hakluyt Society, throwing light on one or two disputed points. On his return from Young's second voyage he was filled with enthusiasm for the renewal of Dutch Arctic discovery, securing the approval and affection of that great authority on such subjects, the late Commodore Jansen. Sir Allen Young came to Amsterdam to see Beynen off on his Dutch Arctic voyage in the little *Willem Barents*, and on that occasion the King of Holland appointed him an officer of the order of the Oaken Crown. Duty obliged Koolemans Beynen to leave the north that he loved, and he died prematurely in the Dutch East Indies. When Lady Markham published a translation of Boissevain's life of Koolemans Beynen she dedicated it to his old chief Sir Allen Young. This work contains a second account of the two voyages of the *Pandora* from the point of view of the young Dutch officer.

It was not long before Young's services were again needed. Leigh Smith had made his second voyage to Franz Josef Land in 1881, a very bad season. On August 21 his vessel the *Eira* was crushed between the pack and the land floe and sank when the ice slackened. The boats and sufficient stores and provisions were got safely on the ice to enable Leigh Smith and Dr. Neale, his very able doctor, to bring the crew through the winter in fair health and comparative comfort, and in the spring of 1882 Leigh Smith took his people in the boats to Novaya Zemlya. All this was of course unknown in England. There was the greatest anxiety when the *Eira* did not return, and I decided that a relief ship must be sent out. Mr. Valentine Smith worked with me very cordially in raising funds. He resolved to offer the command to Allen Young. On March 24 I had a long conversation with him on the subject, and on the 31st he accepted the command. The *Hope* whaler was hired, and nearly every one at Greenwich volunteered. When his mind was once made up Allen Young was as resolute and efficient as ever, and the *Hope* sailed for Novaya Zemlya well officered, well manned and well found.

On June 21 Leigh Smith and his people started in the boats. They met the *Hope* at the entrance of the Matushin Shar. Young brought them all home in safety—a very well-managed and successful little expedition.

Allen Young was knighted by Queen Victoria, and later was created a Companion of the Bath and of the Royal Victorian Order. He was for many years a close personal friend of King Edward and the Royal Family.

In later years Sir Allen Young removed from the corner of Pall Mall and St. James's Street, where hospitality was dispensed to Arctic men of all countries, to Bruton Street, where the Arctic receptions continued. He always took the deepest interest in discovery and in the welfare of his old Arctic friends. Later still he lived in a hotel in Albemarle Street,

where he had to endure a long and tedious illness, and he passed away quietly and without pain on 20 November 1915.

The days of a great sailor have been numbered, a generous and most steadfast friend, and one for whom many will mourn whom we know not, for his acts of kindness were as secret and numerous as they were munificent. Above all we should venerate his memory for the good work he did, and for his modesty in avoiding publicity, an uncommon virtue in these days.

CLEMENTS R. MARKHAM.

A VOYAGE OF THE SPANISH FRIGATE *SANTA ROSALIA*, IN 1774.

Noticia de la Navegación de la fragata de guerra titulada *Santa Rosalía*, **en el año 1774.** Extracto del Diario de navegación de dicha fragata hecho por el Teniente de Navio D. José de Mazarredo. Madrid, 1913.

HALLEY'S voyage for the study of longitude and magnetic variation was conducted in 1699–1700; Frézier's mission followed in 1712–14; and Don Jorge Juan's with Ulloa in 1735 and succeeding years. Dr. Maskelyne's voyage came later, in 1761, and was productive of useful results. It is only by attentively reading the writings of men like these who put their methods to practical test at sea, that we, accustomed to modern precision in steam navigation, come to realize the astonishing uncertainty of the shipmaster's reckoning in bygone times—the guess of the man who depended on the cross-staff and its modifications for his approximate latitude, and pinned his faith on the homely log-line and sand-glass and lead, supplemented by any note he might take of the birds of the air and the colour of the water, to guide his approach to land.

Until the middle of the eighteenth century our neighbours of the Peninsula had made less progress in nautical science than other maritime nations of the first rank, and their *pilotos* or navigating masters seem to have clung to the dead reckoning, even in Don Jorge Juan's time, after "lunar distances" were in general vogue with their competitors and watches of precision were already being tested by some. But the Spanish Navy made a contribution to scientific geography which long remained unpublished; and the Council of the Real Sociedad Geográfica of Madrid has done well to print quite recently, in a separate brochure as well as in its *Boletín* (vols. 55 and 56 of 1913–14), an interesting account written on board the *Santa Rosalia* of that frigate's voyage of research in the Atlantic Ocean. The project was conceived in 1773, and the King, D. Carlos III, entrusted its command to D. Juan de Lángara, an officer already distinguished among his seniors for scientific acumen and especially for proficiency in

navigation. His name is perhaps more familiar to Englishmen, however, as a combatant officer, in connection with Sir George Rodney's victory off Cape Santa María in 1780, and the occupation of Toulon in association with Lord Hood some thirteen years later. Accompanying Lángara in the *Santa Rosalía* were two lieutenants of his own choosing, D. José Varela and D. José de Mazarredo, names honoured by Spanish naval historians for the good work they did both then and afterwards. It is to this last-mentioned officer that we owe the journal of which an excellent summary is now first published to the world—a summary drawn up and signed by the author himself in 1774 and presented to the Madrid Society in 1912 by one of his descendants, Excmo. Sr. D. Antonio de Mazarredo y Allendesalazar. On the MS. being referred by the Council to Excmo. Sr. D. Manuel de Saralegui for examination, that gentleman deemed it deserving of publication and advised that space be accorded to it in the columns of the Society's *Boletín*. Sr. Saralegui's Report is now printed with the document, by way of prologue, and not only throws useful light on the astronomical work achieved by the officers of the *Santa Rosalía*, but supplies some instructive remarks of value to historical geographers in reference to the seldom-described islands of Fernão do Noronha and Trinidad del Sur.

The main purposes of the expedition were (1) to test the most recently devised methods for finding the longitude at sea by measurement of lunar distances, and (2) to study the phenomena of compass variation and determine the course of isogonic lines as they then held good in the Atlantic Ocean. Currents and their relation to prevailing winds were also to be observed, meteorological records were to be kept, and the positions or non-existence of doubtful shoals and reefs were to be verified. Particularly, an examination of the tract about the 20th and 21st parallels for a hundred leagues between Trinidad del Sur and the Brazilian coast was to be made in order to set at rest the vexed question of an island reputed to lie there, to which the name "Ascension" had been assigned, and which was actually laid down on many charts (compare Frézier's 'Voyage to the South Sea,' pp. 290–1 and 320 (English translation, London, 1717)).

The *Santa Rosalía* left Cadiz on 24 January 1774, equipped with several octants and sextants, including one by Edward Nairne, and with four azimuth compasses by prominent makers of whom Mazarredo mentions George Adams, Gregory, and Piefinch. Other sets of instruments were provided for conducting observations on shore at points the frigate might touch at, but whose longitude was not accurately known; and a 7-feet astronomical telescope with micrometer was added for measuring short distances and observing the movements and occultations of Jupiter's satellites, and so forth. But there is no mention of any chronometer or watch being on board, which seems remarkable. After calling at Tenerife, where they purchased a *bergantincillo* to act as tender to the frigate, the party proceeded southwards, passing between the Cape Verde Islands and the African coast. They crossed the equator in longitude by observation 3° 12′ 45″ W.

of Cadiz, where they found the magnetic declination to be 14° 32′ E. The wind being scant they failed to sight the real Ascension Island and therefore edged away to the westward in quest of its reputed namesake. On April 4 they reached and examined the islets of Martín Vaz, outlying sentinels of Trinidad del Sur, from which they bear due east 27 or 28 miles. Two days later the frigate was brought to an anchor off the west side of Trinidad itself; but the violence of the surf, which has often deterred other explorers from landing on it, made no exception in favour of the *Rosalía's* party this time, and the voyage was therefore continued westwards for 100 leagues between the parallels of 20° and 21° in accordance with instructions. An "appearance of land" was twice seen, but the observers were presently disillusioned in each instance; and the "Ascension" of the west (which is really one and the same with Trinidad) was finally set down as having no separate existence—like the phantom isle of Pepys so assiduously sought for by Byron and others a few years previously, which, for some hours, deceived even Captain Cook, and whose imaginary outline was sketched on paper and reported as land by D. Antonio Puig of the flute *Catalana* in 1770. So the frigate returned to Trinidad (del Sur), where a landing was now accomplished, but she and the tender each lost an anchor and the launch was obliged to abandon some water-casks. From thence they shaped a course for Fernão do Noronha, where they anchored in San Antonio's Bay on May 17. Here Lieut. de Mazarredo had a narrow escape from drowning, through the frigate's boat getting capsized in the surf; but he met with a genial welcome from the Portuguese governor, who provided dry clothing and a good meal for all the men in addition to caring for the officer "like a father."

On pages 42 to 47 the narrator gives a physical description of Trinidad, which is rocky and inhospitable. He notes its stunted, wind-swept trees; the multitude of singing birds and seafowl that frequent it, and the many sharks and parti-coloured fishes that abound around its shores. Of quadrupeds they saw only a half-starved boar and a wild goat. There is no mention of the very numerous land-crabs that infest the place. Few traces of human visitors were met with; and nothing is said about the buried treasure that is still reputed to lie hidden there.

Pages 62 to 65 are devoted to an even more interesting account of Fernão do Noronha, its curious fortresses and weird population. From the latter the Spaniards could gain no trustworthy information as to their numbers; but they computed the negro convicts at 300, though the Portuguese authorities pretended there were 1000, and the garrison—whom the Portuguese represented as mustering 1600 soldiers—was reckoned by Lángara to comprise 250 armed men at most. There was not one woman on the island. Cultivation was very restricted, because the land was almost all reserved as pasturage for cattle and sheep in the Government's interest. Pigeons and doves were in vast abundance then as now, as well as a small mammal resembling the *mulita* of Buenos Aires, or possibly the creature

called *paca* in Brazil, a rodent animal allied to the agouti and cavies. Mr. H. N. Ridley, F.R.S., visited this island in 1887, and has described his results in the *Journal of the Linnean Society* (Zoology, vol. 20, pp. 476–7, and Botany, vol. 27, pp. 6–8). Rats and mice were then numerous, but his party found no mammals that could be deemed indigenous there. He has pointed out the interesting fact that Amerigo Vespucci, who was the original discoverer of Fernão do Noronha's Isle (in 1503), mentions *topi molto grandi* in his account as the only animals then met with, except a gecko with two tails. *Mus rattus* and *Mus musculus* are now there in superabundance, and one of the adjacent islets is called "la Ilha do Ratta." But Mr. Ridley has informed the writer that he thinks it impossible any true rat can have reached the place before Vespucci's time, and concurs in believing that the existence of a small rodent, figured, as Mazarredo says, like the *mulita* of Buenos Aires or even the somewhat larger *paca* of Brazil, may account for Vespucci's illusion. The introduction of true rats from time to time, and through them of some epizootic fatal to *mulitas*, might explain the subsequent reduction or extinction of the latter, as is believed to have occurred with the indigenous rats of Christmas Island in quite recent years. The roadstead of San Antonio is described as easy of approach, clear of dangers, commodious and secure; the latitude Mazarredo assigned to it was 3° 50′ S., which is correct. The longitude, computed from nine observations on three successive days, was set down as 25° 36′ 13″ W. of Cadiz, which shows half a degree of easterly error. Halley's "ambition" aimed at no greater accuracy than a whole degree (*Phil. Trans. Roy. Soc. of London*, vol. 7, abridged edition, 1809 (p. 501)); but that was so far back as 1710.

From Fernão do Noronha the *Santa Rosalia* steered for the Azores, sighted Corbo and Flores on July 2, and then proceeded homewards for Cadiz, which was reached twelve days later after a voyage of five months and eighteen days in all, with the loss of only one man out of a complement of 267.

Lieut. de Mazarredo's narrative includes the expedition's records of the observations made for longitude, and various hydrographic details which must have proved acceptable to the Spanish naval authorities at the time, but whose value has since been surpassed by the work of later observers with improved means at their command.

One experiment may be noted: some sargazo weed was boiled and dressed as a salad; this process freed it from salt and it was found to possess the true flavour of pot-herbs, but its keeping qualities were so short-lived as to neutralize any advantage it might otherwise have yielded as an antiscorbutic.

The donor of the MS. has supplied with it an account of Mazarredo's naval career and of his services to geographical science, which were of no mean order. The particulars are gathered from notices published by three biographers, all of them naval officers of distinguished literary merit.

Mazarredo executed a large amount of cartographic work dealing with the interior of Spain, as well as with home and foreign seas; and he was the first person to accurately determine the position of the famous Puerta del Sol. He was also the author of a geographical treatise, and one on navigation, both designed for the instruction of naval cadets. The late Admiral de Paula Pavía relates that the idea of deducing the longitude of a ship at sea by means of astro-lunar distances measured with a sextant occurred to Mazarredo suddenly and independently, one clear night in 1772, while pacing the deck of the frigate *Venus* with his friend and comrade Lángara; and that they instantly busied themselves with putting the project to a practical test and with elaborating the necessary calculations. Other authorities, with less romance, but doubtless greater exactitude, only claim for Mazarredo that he was the first Spanish officer to apply the lunar distance method at sea, of which, before serving in the *Venus*, he had already heard some vague rumours. It would certainly have been remarkable if—at that date—he had not; for certain it is that he was a man of wide knowledge, reading, and experience, and that he rendered useful and distinguished services to the navy and to his country. We therefore cordially congratulate our sister Society in having made the *Santa Rosalía's* voyage better known to geographers at large.

B. Glanvill Corney.

NOTES ON A JOURNEY ACROSS TSA-RUNG.

F. Kingdon Ward.

We have received with these notes a large quantity of survey material from which a map will be constructed. Owing however to the pressure upon our draughtsmen due to the requirements of the war it will not be possible to complete for some time the working up of this material, and under the circumstances it seems better not to delay the publication of Mr. Ward's interesting account of the little-known country he has traversed.—Ed. *G.J.*

IN the following paper I have thought it best to draw attention to certain matters of geographical interest outside the scope of my immediate journey, rather than describe in detail incidents of the journey itself; for the route followed is fairly well known from the records of previous travellers, in the footsteps of one or other of whom I always found myself. I will therefore give only a brief account of the journey and indicate or comment at greater length on more interesting problems to which attention is drawn *en route*.

Leaving Atuntsi in North-West Yunnan on 30 October 1913, we crossed by a good path over a shoulder of the high outlier which rises for 3000 feet due west of the village, and after a terrific descent reached the Mekong. Continuing up the right bank we reached Meri, and turning west began the ascent of the divide by a narrow valley. There are two

types of Tibetan village met with in the Mekong valley and elsewhere, which may be called the concentrated and the diffuse. In the former the small mud-coloured houses have in the distance exactly the appearance of a pile of children's bricks, and closer scrutiny fails to reveal any design in the jumble; in the latter case the houses are much bigger, whitewashed, and often widely separated over the terraces, each smothered beneath walnut and pear trees. Greater difficulties in terracing and distributing the water (which in either case has to be brought some distance along aqueducts) seem to determine the former less picturesque type.

The climb to the Shueh-la takes a day and a half, and the first snow was evaporating in the wind when we crossed in perfect weather on November 2. The view to the west is grand, and it is difficult to realize that one is looking across the Wei-ch'u and Salween valleys into Burma—that is, to the mountains where the Irrawaddi headwaters rise. There is also an extensive view of the Mekong-Yangtze divide all across the eastern horizon. A fine twin pyramidal snow-peak, called Obo, is seen to the north-west, and is not so far off as it appears at first sight, being actually east of the Salween. There is evidence of the former presence of glaciers on the Shueh-la, and as immediately below the pass the glittering snow-slope of the northernmost peak of K'a-gur-pu comes into view on the left quite close to us, this is likely enough.

There is a peculiarity about the flora of this range (the Mekong-Salween divide), separated into two parts as it is by the K'a-gur-pu uplift. South of that snowy portion the alpine and sub-alpine flora resembles that of the Salween-Irrawaddi divide to the west; north of it the flora of the Mekong-Yangtze divide to the east. Thus it seems to be a sort of connecting link between east and west.

The Wei-ch'u is reached in a day's march from the pass, and an excellent mule-road, better than any I have seen in Yunnan, follows the left bank to Peitu. For miles the valley is dominated by a group of snow-peaks in the K'a-gur-pu range behind us, which the pilgrims, going the other way round, keep ever in view.

Crossing the Wei-ch'u below Peitu and ascending the divide to the west we look down on that river flowing to the south behind and to the north in front, which curious phenomenon mazes one's mind considerably; the tangled ridges in the west, backed by Obo, are mostly formed by the capricious course of the Wei before it joins the Salween, a course now well known. It is significant that no less than four rivers in this region of parallel ranges which stretches from the Brahmaputra to western Szechuan —namely, the Yalung in Szechuan, the Yangtze, the Wei-ch'u, and the Ngawchang-hka, a tributary of the 'Nmai-hka in far northern Burma—turn abruptly through 180° and flow for some distance parallel to themselves in an opposite direction; and in the case of the Yalung, Yangtze, and Wei there are no less than three loops lying close against each other, as in the letter N. There must be some common cause for this freak,

probably to be found in the geological history of the country, which has perhaps been subjected to two sets of crust-movements acting at right angles to one another in such a way that the second movement has caused shearing to take place in the ridges thrown up by the first obliquely to their long axes, thus facilitating the junction of rivers originally belonging to different hydrographic systems.

There is a good view of Obo from here; it is seen to lie within the arid region of Tsa-rung, protected from the monsoon by a rain-screen to the west (the Salween-Irrawaddi divide), and its glaciers have evidently retreated some distance.

On reaching the Wei once more the country hereabouts, considering its savage nature and barren aspect, is seen to be comparatively well populated. Politically speaking, Tsa-rung Province, being astride of two out of the three roads to Lhasa, is likely to prove a stumbling-block to Chinese aggression and as great a thorn as Lololand. The people are highly civilized, progressive, and patriotic. Slavery, the old nomadic instinct redirected into trade channels, and the great annual influx of pilgrims seem to be largely responsible for their advancement. The road down (or, strictly speaking, up) the Wei-ch'u here, past Wa-pu and K'a-pu is first-rate. From the latter village there is a path across the Wei bends to the Salween which must pass close beneath Obo, no doubt an accessible peak. Leaving the Wei where it bends round from the east we ascend to another pass, and see right below us the Salween valley with a fine snow-peak in the south on the Salween-Irrawaddi divide. Chiana is the first village on the Salween, and from here we turned south. The lateral extent of the Salween-Irrawaddi divide at this point calls for remark. There is a path —an excellent one, I should think, judging by the beginnings of it which I saw—from Trenge, a village on the right bank. two days' journey south of Menkong, but apparently nothing between these two. The Tibetans say it takes eight days to cross the divide here, and that three passes have to be crossed; for eight months in the year the route is closed. Allowing for exaggeration there is no doubt that the divide here is of exceptional bulk, slit by longitudinal valleys sending tributary streams to the Taron. Here, I suspect, dwell those dwarfs (Nungs, or as the Hkamtis call them Hkanungs, and the Chinese Kuitzu) whom the Tibetans say live in trees because the ground is a swamp full of snakes and tigers, and with whom they trade twice a year, their country lying to the south of Menkong. So much for Tibetan gossip. The late Captain Pritchard came across these dwarf Nungs west of the Taron, and mentions one hut perched in a tree 60 feet from the ground. The snakes and tigers add a picturesque touch which is probably imaginary, but those jungles are quite poisonous enough without them, and the Tibetans seldom cross the mountains to this outlier of their dominions, and then only to take slaves; "trade" is a very euphemistic term for the relationship, I should think. There were at Trenge several dwarf Nung slaves with faces tattooed blue; they must be

far better off in the arid Salween valley than in their own country, for they are well treated.

Does the Salween-Irrawaddi divide cease to be as a distinct mountain range in the north-west beyond the Irrawaddi sources, or does it retain its individuality as the Salween-Brahmaputra divide? From a consideration of the distribution of Himalayan plants in Yunnan I am convinced that it does retain its individual existence, and that the big snow-peak recently discovered in North-East Assam on the main axis of the severed Himalayan range is its western limit; in other words, that it is directly continuous with the Himalayan axis, having the appearance of an offshoot or spur from the latter, though actually formed otherwise. The term "Salween-Irrawaddi divide" then, for this great curved range, besides being very cumbrous, does not accurately describe it; though undoubtedly for the greater part of its length it does form the divide between those two rivers. If there is one range more than another of these narrow divides which deserves a distinct name it is the Mekong-Salween divide, *the* great divide, for it parts water flowing to the Indian Ocean from water flowing to the China Sea; and it has too something of the characteristics of Wallace's Line, separating the monsoon (Oriental or Indo-Malay) flora and fauna to the west from the Chinese to the east. Further, it separates the Tibeto-Burman family from the Chinese family, and has in reality considerable significance as a great barrier. From Chiana it is two or three days' march down the river to Saung-ta, where the Lutzu tribe begin to appear. The Lutzu speak a language very similar to the Nung language of the Taron, and I suspect the tribe of having arisen as a cross between Tibetans and their Nung slaves. In the south they approach the Chinese, or I should say rather have been influenced by them; in the north they have been influenced more by the Tibetans. They are a very small tribe occupying only a few miles of the Salween, and would doubtless have been driven out by the Lisus in the south had they not been protected by the Tibetans.

In summer we leave the Salween at Laung-ta, which then plunges through a wonderful granite gorge, and make a two days détour into the mountains, returning to the river again at the lower entrance to the gorge. Within a distance of 10 miles or less the climate of the valley entirely changes. In winter, however, the mountain path is blocked by snow, and for the short stretches required where no path is practicable the gorge is navigable if perilous.

The canoe-route is much used in winter, when trade between the Lutzu and Tibetans is carried on, salt from Tsa-rung being exchanged for maize flour and rice from the lower Salween, but it would seem with annual loss of life. Captain Pritchard speaks of the Taron as cutting through a similar granite gorge over the walls of which every tributary stream cascades, as is the case here too, and the scenery on the two rivers must be very similar. Relics of volcanic activity—hot springs, crater lakes, and even dead volcanoes—are found all down this frontier, and granite enters

largely into its composition, cropping out from the beds of the Salween, Taron, Mekong, and Yangtze to the crests of the Mekong-Salween and Salween-Irrawaddi divides; in its southern part the latter range is composed almost entirely of granite, with outcrops of limestone.

From the pass over the spur above Saungta we get another view of the Salween-Taron divide, with a second snow-peak overhanging Cham-p'u-t'ong; but nothing beyond is visible, though the view to the north is extensive. As soon as the rainy region of the Salween is reached at Cham-p'u-t'ong the passes over the western divide become more frequent. At Cham-p'u-t'ong itself the divide is at its narrowest, and the journey from river to river takes three days. In the south, beyond the Nam-tainar-Taron confluence to the west, its lateral extent again increases tremendously, for though the crest of the divide almost overhangs the Salween, the 'Nmaihka is much further to the west; and the divide on that side is dissected by rivers flowing for some distance parallel to the main rivers, owing to the fact that the monsoon is mainly discharged on the west flanks of the divide. The ultimate result will no doubt be that the Taron will cut its way back till it taps the Salween, as the latter will similarly tap the Mekong, thus entirely changing the hydrography of this region. The Salween already flows 1000 or 1500 feet below the level of the Mekong, and the Taron bed is again lower than that of the Salween.

In the Mekong valley itself the rainfall is negligible. Besides the Cham-p'u-t'ong pass to the Taron, there is a second just north of that village, and a third from Bi-bi-li, half a day's journey south. Beyond that comes the route from Yuragan, followed by Prince Henry of Orleans in 1895, and south of that again the main road from Su-ki. Half a day's march south of Su-ki is a sixth pass, and beyond that again near Latsa a seventh, which however takes you over into the Achyang basin. As we go from the arid to the rainy region of the Salween we leave behind all the snow-peaks on the Taron divide; but the passes are snowed up annually for a much longer period in the south.

Between Menkong and Yuragan, a distance of over 100 miles, no European has crossed the divide, though this stretch, containing two fine snow-peaks and concealing perhaps in its northern valleys the nucleus of the dwarf Nungs, is the most interesting part of it. Within these limits also is included the extraordinary change in the Salween valley from a monsoon climate and flora to semi-desert conditions—and it would be intesting to trace the change on the divide itself. The first snow-peak—that above Cham-p'u-t'ong—probably separates two climates and floras on the range, as does K'a-gur-pu on the Mekong-Salween divide; though it will not be so abrupt and sweeping a change as we meet with in the valley. In this connection it is worth noting that the alpine flora of the Salween-Irrawaddi divide in lat. 26° (Hpinaw, north-east frontier) is very similar to that of the Mekong-Salween divide in lat. 28° (Doker-la), while the flora of the Mekong-Salween divide in lat. 29°, north of the

K'a-gur-pu uplift, is very similar to that of the Mekong-Yangtze divide, as already pointed out. It would therefore be very instructive to know whether the alpine flora of the Salween-Irrawaddi divide alters as we go north. If it does not the flora of all three divides must have been derived from a common stock in the north-west, this being the Himalayan line of migration; while the easternmost ranges have passed a Chinese flora along southwards as well. Under present conditions, at any rate, the valleys are physical barriers to plant migration from range to range.

The key to communication between the Salween and Taron might seem to be the Cham-p'u-t'ong Pass, as this leads straight from one river to the other, at the narrowest point. But the Mekong is not so easily reached from Cham-p'u-t'ong, whereas by crossing into Tsa-rung by the Trenge Pass one finds oneself immediately on a good system of mule-roads into China and Tibet; it is, however, this pass which the Tibetans say is so difficult that it takes seven or eight days from river to river, there being three distinct passes to cross. The fact is the Taron is so inaccessible from every direction that any trade route attempting to link up either Assam and China or Burma and Tibet will avoid it as far as possible; in itself it cannot be worth tapping, for its resources, such as they are, must by now be well known to both Tibetans and Chinese. Cross-communication through the Burmese hinterland has evidently never been considered worth while, not even when the Tibetans spread as far south and west as the Hkamti plain. At any rate all the Tibetan roads now run round north of the Irrawaddi sources, avoiding that system as far as possible, while the several routes from the Salween *viâ* the Achyang, Mehk, and Laking valleys to the 'Nmai valley, followed by the Chinese stop there, never attempting to cross the 'Nmai-hka to the Triangle—the tract of country between the 'Nmai and Mali rivers, south of the Hkamti plain.

A few words about the granite gorge of the Salween already referred to. The path is on the left bank at the lower entrance to the gorge, and the precipices which have to be climbed up and down notched logs jammed tightly against the sheer cliffs make it exciting work. At one point a cyclopean granite boulder occupies the middle of the river; in winter it stands 20 feet clear of the water, but in summer it is covered. For a mile here the rapids are practically continuous, and, hemmed in by bare cliffs, the noise is tremendous. Pot-holes and smoothed confluent concavities occur high up on the cliffs, and there is a jumble of big boulders exposed in winter along one bank. The scene here in summer must be extraordinary. A little higher up we cross to the right bank by canoe, and the path continues on that side for a while, then recrosses to the left bank, and so back to the right bank again. Just at the upper entrance to the gorge the river-bed drops several feet, and over this terrific rapid the heavy canoe, big enough to seat fifteen people, has to be carried along the shore. As already stated accidents in winter are common in the granite gorge; once in the river there is small chance of getting out again,

and the water is generally very cold in January, being then almost entirely derived from glaciers and melting snow. On November 9 it was 46°, but by January 4 it had fallen to 38°.

A MEASURE OF CIVILIZATION.

The Distribution of Civilization.— Ellsworth Huntington. Pp. 35. New Haven: Yale University Press. 1915.

IN the autumn of 1913 Prof. Ellsworth Huntington embarked upon an attempt to measure and map the variations in civilization throughout the world. He planned to produce maps with a threefold utility. In the first place, he states, such maps would be intrinsically interesting; secondly, they would yield opportunities to lay more stress upon human character in future geographical, historical, sociological and economic discussions; and thirdly, they would provide a measure of various human qualities whereby the effects of physical environment, race, biological variations, etc., may be tested.

The higher elements of civilization, in his view, include the power of initiative, the capacity for formulating new ideas, the power of self-control, high standards of honesty and morality, the power to lead and control other races, the capacity for disseminating ideas and for carrying new ideas into effect. During the inquiry it became obvious that this list of elements lays insufficient emphasis upon æsthetic characteristics.

An investigation of this kind necessitated the invention of a new method, for Prof. Huntington concluded that the statistics tabulated and published by the several governments were both insufficient and too unequal for the purpose of a world survey. He therefore relied upon the opinions of well-read and experienced investigators. Over two hundred people in twenty-seven countries were asked to co-operate; some of those were geographers, others were ethnologists, travellers, historians; all were held to possess an extensive knowledge of the world, usually through personal experience, but in a few cases through reading. The world was divided into 185 areas, and collaborators were asked to divide these areas into ten groups, so that group 10 should be, in their opinion, notable for the highest development of civilization, and group 1 the lowest. A smaller number of helpers were asked to treat North America by the areas of individual states and provinces in a similar fashion. By means of suggested cautions to collaborators and precautions taken in averaging the results, Prof. Huntington eliminated prejudice, racial bias and technical inaccuracies in his results. Over fifty people made classifications, and over eighty others sent replies of which use could be made. The countries represented by the 54 collaborators were those of Western Europe as well as Russia, Portugal, Spain, Italy, Japan, China, Australia, Canada

and the United States. Some of the many criticisms sent among the replies are quoted in the pamphlet.

The results of the investigation are published upon maps of the continents; and the reader may be advised to follow the brief summary which is given below upon maps of the continents which show density of population. In Europe a nucleus limited by Cape Wrath, Stockholm, Danzig, Genoa, Marseilles, and Brest is marked by numbers between 90 and 100, to represent the highest civilization; England, including Wales, is alone credited with 100. North-eastward to the tundra the values drop to 29, eastwards to the Caspian to 46, south-eastwards to Turkey in Europe to 61, with 56 near Montenegro, and southwards in the Mediterranean to 70. In Asia, Southern Japan has 83, Eastern China from 60 to 66, the Indian triangle between Lahore, Bombay and Calcutta from 50 to 53, and elsewhere the numbers decline to the lowest, 13, between the Ob and Yenisei. In Australia the values range from 39 in the north to 86 near Sydney; in Africa they run from 19 in the Sahara to 72 in the Cape Province; and in South America from 23 in the Amazon Valley to 71 near Buenos Aires. The general opinion concerning North America, based upon all the work, is that a nucleus from the East Coast between Maine and Cape Hatteras extending as far as the Mississippi should be valued higher than 90, with a value of 100 near New York. A second high area occurs near San Francisco valued at 90. The lowest value in the United States is 73, near the Southern Rockies. In Canada the Lakes Peninsula is highest with over 90, and the Arctic shores lowest with 17. Mexico is valued at 51 and 64, and Central America drops to 46. Density of population maps give very similar results provided that areas where railways are numerous or where the inhabitants enter into world-commerce are given higher values than the density of population in the scantily peopled continents warrants.

Criticism of Prof. Huntington's results as published may be confined to two matters of prime importance. In the first place, it is extremely doubtful whether the elaborateness of the method was either valuable or necessary; and secondly, the numerical values are useless for most of the purposes for which Prof. Huntington designed the investigation. The first point may be dealt with by means of material contained in the pamphlet itself. The numbers give two sets of comparative results: in the first case, they suggest for each continent a list, in order of merit, for the component areas of the continent; and, in the second case, they suggest an order of merit for the highest civilized areas in the continents. The maps of North America supply material in connection with the units of a single continent. There are six of these maps, five based upon the averaged opinions of groups of Americans, Britons, Germans, Latins and Asiatics respectively, and a sixth map which generalizes the whole. Take a section roughly along parallel 40° N. and note the values on each of these maps, and draw curves based upon the values so obtained. The

six curves are fundamentally alike. They end highest at the east, they commence almost as high on the west, they drop very suddenly on the way from the west eastwards and rise slowly to the maximum. They differ only in the range of the curve. A similar curve based upon densities of population shows precisely these changes, except that the western end is not proportionately so high. From this it follows that the reader may easily obtain a similar map to those of Prof. Huntington by an examination of a population map, making allowance for railways and world-trade as suggested. The process could be repeated continent by continent. Now turn to continental comparisons. Prof. Huntington publishes a table supplied by a single investigator, Mr. Ten Kate, who treated seven of the characteristics laid down by Prof. Huntington along with three æsthetic characteristics. He considered eleven areas and provides a list of average values based upon the ten characteristics. Prof. Huntington supplies a list of average values for the same areas based upon the work of his fifty-four collaborators, and the present writer has made a list based upon Mr. Ten Kate's values for the seven non-æsthetic characteristics previously mentioned. There are, thus, three lists in order of merit for the eleven areas. In all these lists Great Britain, Germany, and the United States make a group of best countries practically equal; Japan and Italy form a mean group; and Mexico, Argentina, and Paraguay form a worst group. The remaining three areas, Northern France, the Netherlands, and Switzerland vary from list to list in relation to the best and mean groups. This variation does not affect the point at issue, since attention is to be confined to the best areas in each continent, *i.e.* to Britain, the United States, Japan, and the Argentine. Three tests based upon the method of opinion have given the same results, and these results are practically the same as those which would be obtained by considering density of population in conjunction with world-trade and transport. The added æsthetic values cause no variation. These considerations suggest that for scientific purposes the detailed and laborious method gives no better results than would be obtained by an individual after a few hours' thought. This means that the minutiæ which were considered by the fifty-four collaborators are lost in the averages upon which the maps were based. It may be noted, in this connection, that the collaborators worked on a basis which gives a possible error of 5 per cent., and that Prof. Huntington seems inclined to attach importance to differences of no more than 1 per cent. No chain is stronger than its weakest link.

Let us consider now the further point regarding the uses to which the maps may be put. Prof. Huntington suggests that they should be useful in comparisons between civilization and, on the one hand, elements of physical environment; on the other hand, human or social elements. The consideration of two analogies may serve to show that Prof. Huntington has not given sufficient attention to the results of *averaging* the opinions of his collaborators. Firstly, set ten people to the estimation,

without precise measurement, of the weight, density, volume, elasticity, symmetry, and the depth of surface tint of ten objects of different sizes and shapes, made of different substances, and superficially coloured in different shades of red. Let them express their estimates by a scale with 10 for the heaviest, densest, etc. Average the results into one list with a maximum value of 100. Block A has a value 100, block D has a value 86. What do these values mean? Block A possesses each characteristic in the highest degree, and block D belongs to a second rank. But what do we mean when we put block D in a second rank in comparison with block A, and what can we infer therefrom? Surely we can draw no valid conclusions. Does the Australian at his best, rank 86 on the map, belong to a second rank of people in comparison with the New Yorker or the Englishman, rank 100 on the map? Because the people of Sydney rank at 86 and those of New York rank at 100, are we to infer that the New Yorkers are more honourable, more moral, more pushing and go-ahead in business, more fertile in new ideas, or have a higher ethical and social outlook than the people of Sydney?

Secondly, consider the total annual average rainfall of London and Agra, which agree at 27 inches. Should we infer from this average value that the rainfall at the two places is similar in type? Or, given that the rainfall in the London district suffices for an intensive cultivation of the soil, are we to infer that the rainfall of Agra similarly suffices for intensive agriculture?

From the point of view of scientific method it would thus appear that Prof. Huntington's averages can serve very few useful purposes. Is the work then a waste of time and energy? By no means; the important material for consideration lies in the collected data which are in Prof. Huntington's hands. Valuable results should be obtained from the differences between the opinions of one collaborator and another, or between one set of these people and another group. All these differences have been eliminated from the maps, and it is only the consideration of them which will make their collection worth while. It is a matter of the greatest scientific importance that the maps as they have been published should not be used as the basis of any judgments about the non-material, *i.e.* human or social, elements in the geography of the world.

Prof. Huntington quotes adverse and laudatory opinions upon the plan which he has put into operation; these opinions are largely beside the point since they do not refer to the results which have been published. "Ambassador" Bryce is worth quoting: "Your idea is ingenious and interesting, and I should much like to see how it works out, though it seems to me, on first impressions, that the various factors involved are so many and so complex that the visual presentation you contemplate would need an amount of comment and explanation which would require something like a treatise to accompany the map."

B. C. WALLIS.

REVIEWS.

EUROPE.

Belgium.— R. C. K. Ensor. (The Home University Library.) London : Williams & Norgate. 1915. Pp. 256. *Sketch-maps.* 1*s.* net.

AN authoritative but compact work, consisting mainly in a sketch of the history of Belgium, and of its social conditions as before the beginning of the war. "It would be difficult," says the author, "to name any nation in whose history [Geography] has been a more important or more constant factor"; and a clear and readable chapter is devoted early in the book to a geographical sketch of the country. A bibliography and index complete a very useful little volume.

Denmark and the Danes. A survey of Danish life, institutions and culture.— W. J. Harvey and Christian Reppien. London : T. Fisher Unwin. 1915. Pp. 346. *Sketch-map and Illustrations.* 12*s.* 6*d.* net.

The scope of this work is sufficiently indicated by the sub-title. An introductory geographical chapter is somewhat sketchy, but such topics as pastoral industries and co-operative methods are fully and clearly treated of; and the book will be welcome as an addition to the few good English books on a most interesting State.

AFRICA.

Missions au Maroc. En Tribu.— Edmond Doutté. *Photographs, Coloured Plates and Plans.* Paris : Librairie Paul Geuthner. 1914.

'En Tribu' is a description of parts of Morocco visited by M. Doutté during 1901–1907. A large portion of the volume is taken up with an account of the Hauz region south of Marakesh, the crossing of the High Atlas by the rarely used pass of Mîri, and the Sus province. There are also chapters on the Atlantic coast lands, these leading to a fascinating review of the vestiges of the period of Portuguese dominion. To give it greater actuality the author has cast his narrative in diary form, but the whole wealth of his knowledge of each district is here gathered together.

M. Doutté's main concern is with the people, but he knows that land and folk cannot be divorced, and his first care is to picture the country he traversed and the towns he visited. For this task he has an enviable gift—his pictures are charged with colour, atmosphere and imagery. At the same time they are precise and full of detailed information. One might cite as an example the story of the ascent to the Tizi n Mîri, past the last habitations of man to the scanty remnants of the forest which anciently covered the slopes of the Atlas. The destruction of the forest (which conjures to mind a countryside where all the youth have flocked to the towns and only the old are left to wither and decay) is attributed mainly to the agency of man, and but little "to some slow change in climate." What man has destroyed man alone can remake, and he can even fight against the climate. If M. Doutté has the eye of the artist he has the mind of the regenerator, and he sees endless possibilities in Morocco if only the evolution be natural and no attempt be made to impose a foreign civilization on the Moors.

The description of the country, as has been indicated, serves as background for a study of the tribes. We have unrolled for us the daily life of the people,

their racial characteristics, their mentality and, notably, their spiritual and religious standpoint. Special interest attaches to M. Doutté's investigations into the pre-Islamic beliefs of the Berbers, and the manner in which the Makhzen endeavoured to extend its authority by strengthening orthodox Islamism; also to his accounts of the tribal marabouts, "the last survival of the Priest-kings and Divine-kings of the ancient ages of humanity." Valuable light is thrown on the condition and origin of the Jews of the High Atlas and Sus. There is reason to regard them as descendants of Berber tribes converted to Judaism before the era of the Moslem invasion. These "native" Jews have now disappeared from the Arabized regions of Morocco.

We have given but a very inadequate indication of the merits of this book, which should be read by all students of Moroccan affairs, and indeed by all lovers of travellers' tales. The illustrations, mostly from the author's photographs, are excellent. They include beautiful reproductions in colour of eight paintings by A. Corson, and half a dozen plans. Criticism is confined to one or two points. The book is bulky and would be better in two volumes; there is no map, no index, no list of illustrations. It might be urged, with respect to the absence of a map, that M. Doutté did not explore unknown territory, but though an elaborate map may not have been needed, a sketch-map should certainly have been given. Not to be able to trace the route followed or to locate the places named, in a country still largely unfamiliar, without reference to an atlas, is a source of annoyance to the reader.

F. R. C.

The Northern Bantu. An account of some Central African Tribes of the Uganda Protectorate.— Rev. John Roscoe, M.A. Cambridge University Press. 1915. 12*s.* 6*d.*

Those who have followed the writings of the Rev. John Roscoe, formerly a missionary in the service of the Church Missionary Society in Equatorial East Africa, will not be disappointed in the latest work he has issued on the subject of the Bantu tribes of the Uganda Protectorate. He deals in the present volume with the Banyoro, the Banyankole, the Bakene, the Bagesu, and the Basoga; together with some additional information regarding the Nilotic Teso (which he rather misleadingly calls Bateso) and Kavirondo. He describes their native forms of government, their clans, totems, and terms of relationship, marriage, birth, and death ceremonies, treatment of the sick, their native industries, their methods of warfare and of hunting, and their religious beliefs. He also gives some description of their physical appearance, though in that respect not going into much detail. Ethnologically the book is of first-rate value and importance, and the style in which it is written deserves special commendation. For it is scientific, informative, and yet simple in diction; entirely free from sentimentality or White-man's prejudices of any kind. Mr. Roscoe may claim to have made a distinct addition to our ethnographical knowledge of this part of Africa in having virtually discovered the Bakene lake-dwellers of the Kioga marshy region, which extends from the north of Basoga almost to Karamojo. Mr. Roscoe indeed asserts that outlying clans of the Bakene have wandered as far north as the shores of Lake Rudolf. If so, they must be almost the most northern representatives of the Bantu language family. He expresses no opinion as to whether in that region they are the relics of a former much more north-easterly extension of the Bantu-speaking negroes, or whether they represent recent migrations from south-west to north-east. He gives no specimen of their language, but states that in that respect they display a very close

affinity with the Basoga; and the Lusoga language, as the reviewer has set forth already, scarcely shows more than dialectal differences from Luganda. It is obvious, however, from remaining place-names that a Bantu-speaking population at one time overspread much of the Mountain Nile basin between Karamojo on the east and the Bahr-el-Ghazal basin on the west, and that they were subsequently displaced by invasions of the Nilotes and of the Nandi and Masai groups and of the Sudanic Madi.

Mr. Roscoe gives a full description of the little-known Bagesu people of the western and north-western slopes of Mount Elgon. He states that they are cannibals in the sense that they consume portions of their dead, throwing out the bones and what is distasteful in the flesh to be devoured by hyenas and jackals. I visited these tribes in 1901 and found them to be speaking perhaps the most archaic of all Bantu languages. I heard their tribal name pronounced as Gishu as well as Gesu. It is possible that they once had a much wider range, and that their name still lingers in the term Waso-ngishu plateau, now outside the Bantu range and more or less in occupation of the Masai.

H. H. JOHNSTON.

Savage Man in Central Africa. A Study of the Primitive Races in the French Congo.— Adolphe Louis Cureau, Gouverneur Honoraire des Colonies. London: T. Fisher Unwin. 1915. 12*s.* 6*d.*

This book will be a disappointment to all whose knowledge of Africa has advanced beyond mere generalizations and who are sticklers for accuracy in detail and locality. Yet we notice that it has already been favourably reviewed and referred to in newspapers that are content to adopt somewhat ancient and discarded theories regarding the Negro. Though presumably the author has resided long in the Gabun and in the interior parts of French Congo, a perusal of the work conveys to the specialist the idea that it is not based on much direct personal observation and note-taking *in loco*, but to general remembrance and much reading of other authors. Undoubtedly it is interesting, because it is written in a pleasing style, but we question whether the general impressions it conveys were accurate at any time. They are certainly very old-fashioned as regards the present condition of many tribes in Western Congoland. One might also ask whether it is any more permissible to generalize about Negro Africa than about Caucasian Europe. It is as difficult to give an accurate and yet a generalized picture of the very diverse Negro and Negroid tribes of Western Equatorial Africa as it is to give a general description of the Europeans of Western Europe. One African village is not of necessity any more like another African village than Segovia is like Paris, or Marseilles like Ypres.

H. H. J.

Société de l'Histoire des Colonies Françaises. Premier Voyage du Sieur de la Courbe fait à la coste d'Afrique en 1685.— Publié avec une Carte de Delisle et une introduction par **P. Cultru.** Paris: Edouard Champion; Emile Larose. 1913. Pp. 321.

This is, from a geographical point of view, the most interesting of the valuable series of publications of the Society mentioned in the title, the foundation of which in 1912 was referred to at the time in the *Journal* (vol. **41**, p. 174). It reproduces for the first time the original text of one of the earliest French

narratives of travel on the west coast of Africa, written by an employé of two successive French companies operating in Senegal, whose name has hitherto been practically unknown to historians. This neglect is to be laid to the charge of the French Dominican J. B. Labat, the compiler of several well-known descriptions of West Africa based on the narratives of travellers, who has been known to have been none too scrupulously careful in the use of his material, though the extent of the liberties which he permitted himself to take therewith has only lately been brought to light by a fortunate discovery by the editor of the work now before us.

M. Cultru, who has been known for some time as a keen student of the history of the French West African Colonies, lighted a few years on two MS. documents preserved in the Bibliothèque Nationale, one of which, in a late seventeenth-century handwriting, contained the first part of a narrative entitled 'Premier voyage du Sieur La Courbe au Sénégal en 1685,' the other including André Brue's Journal during the Arguin Expedition of 1723. On examination it proved that while the latter was reproduced in the first volume of Labat's 'Relation de l'Afrique Occidentale,' the basis of the four succeeding volumes was the narrative of La Courbe then for the first time brought to notice, and this though all the journeys therein described were assigned by Labat to Brue, under dates altered to fit in with the facts of Brue's career. Whole passages, M. Cultru shows, were embodied verbally in Labat's work. What was his precise motive in thus glorifying his hero at the expense of another cannot now be guessed, but the result has been to perpetuate an injustice done to La Courbe, who seems to have been a man of some culture and of an inquiring mind, besides possessing a certain descriptive faculty which we have now no reason to attribute to Brue. A later find brought to light the end of La Courbe's narrative, with a gap of sixteen pages only between it and the former section.

In this narrative we have a document of great importance for the early history of Senegal and for a knowledge of the ethnological relations of the peoples of that region in the period in question. M. Cultru supplies an introduction setting forth, in addition to the facts above mentioned, the chief events in early French enterprise in this part of the world, and such details of La Courbe's career and West African experiences as he has been able to glean by careful search. The whole forms a volume of much interest and value.

E. H.

AMERICA.

Canada and Newfoundland.— H. M. Ami. Vol. 1 of North America in Stanford's Compendium of Geography and Travel (New Issue). London: Edward Stanford. 1915. Pp. xxviii., 1069. *Maps and Illustrations.* 15*s.* net.

The appearance of this book is very welcome, for a "revised and extended" edition of Dr. Dawson's volume was necessitated by the advance of our knowledge in many respects, by the changes effected by man over much of the area, and by the increased knowledge of the regions treated, since the publication of the first edition in 1897.

We have now a store of the most recent facts regarding the present conditions in the Dominion and the Colony. The book is indeed a compendium of information which should be at the disposal of all who study the region; we do not praise it unduly if we say it must be considered as indispensable, for it

is packed with facts, it deals with all aspects of the geography, and it embodies much that it would be difficult or impossible for a student on this side of the Atlantic to obtain even with the ajd of the long Bibliography appended to the volume; moreover, study is facilitated by many maps, nearly 200 illustrations, and a full, though not quite complete, index.

Yet we must confess to some disappointment, for the book has been brought up to date in regard to its facts, but the spirit of the modern study of geography does not animate it. To a large extent it is a collection of more or less unrelated details which might be, but are not, formed into an organic whole; the facts are arranged into categories but not inter-related; the regions are described but seldom explained. We regret the omission of any contoured map except one measuring about 6 in. × 3 in., and also the absence of any general geological maps.

In general we find the book unusually accurate and trustworthy, but we must prescribe Chapter VI. of Sir John Murray's book 'The Ocean' as an antidote to the statements on p. 7 regarding the "dominant cause" of the direction of ocean currents. It is obviously a misprint which asserts that "the air rises 10° C. for every 400 feet it descends" (p. 676), and there is more than one statement so ill-expressed as to cause misunderstanding at a first reading.

Messrs. Stanford are doing a service in re-issuing this volume of their "Compendium," but we hope that a future issue may show a development from the *compendium* stage, and provide us with a book in which the geographical point of view is preserved and a unity is evolved.

J. F. U.

Mineral Resources of Minas Geraes (Brazil).— Albert F. Calvert. London: E. & F. N. Spon. 1915. Pp. xvi. and 100. *Maps, Sections and Illustrations.* 6*s.* net.

Mr. Calvert has extended the list of his mining works by an excursion into a new country; and this is probably the most complete description of the mineral wealth of Minas, being compiled largely from reports by experts on the spot. The illustrations are numerous, but the value of the work would have been much enhanced by the addition of an index and of a systematic bibliography instead of mere references in the text of the book.

GENERAL.

Early Engraving and Engravers in England (1545-1695). A Critical and Historical Essay.— (Sir) Sidney Colvin. London: British Museum, etc. 1905. Large folio. Pp. 170 and letterpress with each plate. *Photogravure and other Facsimiles.* 105*s.* net.

Through the liberality of the Trustees of the British Museum the Society's library has become the fortunate possessor of a copy of this sumptuous work, which, apart from its general interest for the history of copper-plate engraving in this country, has a distinct value to the student of the history of British geography and cartography. In modern times map-making has become to such an extent a thing of mere practical utility that its connection with engraving as an art is by no means close. But in the early days it was otherwise, and in the period treated of in this volume, especially the earlier half of it, maps played a quite appreciable part among the subjects dealt with even by the most accomplished exponents of the art; while it is the subsidiary

embellishments introduced by them which, in Sir S. Colvin's words, "make of these old maps such pleasing works of art and fancy."

It was only in the reign of Queen Elizabeth that line engraving on copper, which had long been cultivated, and with brilliant success, on the continent, began to take root in this country, and the simultaneous great development of foreign enterprise at the hands of the Elizabethan navigators gave a natural scope for the exercise of the art in the direction of maps of the newly found regions. Among the earliest engravers in this country many were foreign craftsmen who resided here for a time and in this way helped to stimulate the native talent. The author deals alike with the work of foreigners and natives so far as it was done in England or at least had some connection with this country; taking the foremost names in turn and describing and illustrating the principal productions of each. The foreign craftsmen chiefly concerned with map-making were Remigius Hogenberg, engraver of some of the maps in Saxton's Atlas of the English Counties, and possibly too of the fine frontispiece with the portrait of Queen Elizabeth; Theodor de Bry, who took part in the preparation of Ashley's 'Mariner's Mirror' (the English version of Waghenaer's 'Spiegel der Seevaart'), and whose *magnum opus*, the great illustrated collection of travels, owed its inception, it should be remembered, to his visit to this country and relations with Hakluyt and other Englishmen; and, above all, Jodocus Hondius, who worked in England between 1580 and 1594, and engraved the gores for the "Molyneux" Globes, besides also helping with the 'Mariner's Mirror' and producing other maps before returning to Holland in 1594 or 1595. Even after this he kept up his connection with English friends, and his famous 'Christian Knight Map' (so-called from the representation, on the blank space of the Southern Continent, of the Christian Knight's victory over sin, the flesh, and the devil) was dedicated to three of them—one being Edward Wright, with whom he unfortunately had a breach later. His map showing the routes of Drake and Cavendish (reproduced last year in the *Journal* with M. de Villiers's paper, vol. 44, p. 180), must have been based on information supplied from this country. Sir Sidney reproduces the section of the earlier map showing the Christian Knight, and also the portraits of Drake and Cavendish which accompanied the map of their routes. While it is no doubt the fact, as the author states, that the portrait of Drake was widely copied, it seems possible that it was itself based on the much superior engraving by Thomas de Leu (from the portrait by Rabel) of which a reproduction was lately given in Mrs. Nuttall's 'New Light on Drake.' Hondius also engraved the maps for Speed's 'Theatre of the Empire of Great Britaine' (1611).

Of *English* map-engravers one of the most meritorious was Augustine Ryther, whose work for Saxton's Atlas is pronounced by Sir Sidney to be "distinctly the best in the book, not even excepting that of R. Hogenberg." It perhaps included the frontispiece, of which a reproduction is given as the frontispiece of the present work. Ryther also did much for the 'Mariner's Mirror,' engraved Agas's map of Oxford and Hamond's of Cambridge, besides producing the fine set of maps illustrating the defeat of the Spanish Armada. Benjamin Wright, of whom little is known, engraved various maps, some only lately brought to light, but much of his work was done abroad. Mention should also be made of William Hole, concerned in the illustration of 'Coryat's Crudities,' John Smith's works on Virginia, Camden's 'Britannia' and Drayton's 'Polyolbion'; of William Kip, engraver of Norden's 'Hartfordshire,' and of thirty-three of the maps in Camden; and of Robert Beckit, who produced the maps for the English edition of Linschoten (1598). British

cartographers of the time, not themselves engravers, likewise meet with some attention.

The object of the work, as explained in the introduction, is "to put into the hands of students a set of facsimiles, the best that modern methods can produce, of some forty of the finest and most characteristic examples chosen from the National Collection, and at the same time to set forth, more exactly and consecutively than has yet been attempted, and with the help of many subsidiary illustrations in the text, what is known and can be ascertained concerning the origins and early history of the art in England." To say that this object has been admirably compassed is sufficient indication of the general value of the publication, which is perhaps inadequately set forth in the above account of that side of the subject-matter in which we are more immediately concerned. Portrait engraving, as well as that of emblematical title-pages, naturally occupies a large share of attention. Not the least important section is the catalogue of engravers, with lists of their works far more complete than any previously attempted. E. H.

Le Problème Colonial.— **Henri Hauser.** Paris: Librarie Chapelot. 1915. Pp. 113. 1 *fr.*

A careful study of colonial questions as causal factors in the present European crisis, and in turn of the influence of the war on the colonies. Tracing the tardy development of Germany's oversea empire, and her later endeavours to secure a footing by diplomatic and financial means in other regions (*e.g.* Morocco and Mesopotamia), M. Hauser hopes that the war may result in the permanent removal of "un colonisateur médiocre . . . une puissance coloniale turbulente, aggressive, toujours insatisfaite;" and on the other hand, sees little but good in its effects on the colonies of France and England, on the one hand frustrating the German hopes of an Islamic revolt, and on the other settling, in the best sense, questions waived by the British Imperial Conference.

The North-West and North-East Passages, 1576-1611.— Edited by **Philip T. Alexander.** (Cambridge Travel Books.) Cambridge: University Press. 1915. Pp. xx. and 211. *Sketch-maps and Illustrations (many in facsimile).* 2*s.* 6*d.* net.

The first of a new series of books for school use, "whose aim is to illustrate the history of discovery by means of select voyages and travels" reprinted from the originals (the spelling being modernized) and with the original illustrations. The present volume gives extracts from the voyages of Frobisher, Davis, Hudson, and Barents, with a short introduction and explanatory notes. The vivid interest of these early voyages, told at first hand, should render the work at once popular and useful.

THE MONTHLY RECORD.

AFRICA.

The Shores of Lake Chad.

An official of British Nigeria, Mr. G. J. F. Tomlinson, a Fellow of our Society, writing from Seyoram on the western shores of Lake Chad, gives a vivid account of his first impressions of the lake, which he had seen for the

first time on the morning of the day on which the letter was written. The approach to its shores struck him as most impressive, and the realization of his long-cherished dream of visiting the lake does not appear to have brought disappointment. He says, "Yesterday I trekked north from Mongonu to Kauwa through gradually thinning bush and heavy sand. I slept at Kauwa and came on here (17 miles) this morning. For the first few miles there are still a few stunted thorn bushes and the ordinary rank grass of Nigeria. Then one rides through a belt of grass thickly covered with a hideous corpse-like weed called by the Hausas *tumfafia*, which here grows as high as 10 feet. This finally thins out and ceases, and one enters an immense steppe covered not with the tall rank tropical grass, but with fine fresh herbage about a foot high. Not a stick nor even an antheap relieves the expanse of green. Even if one did not know what lay ahead one would instinctively feel that a dramatic change was coming. After another 5 miles one becomes aware that the edge of the plain is water, and Chad is in sight. At this point the shore is free from swamp and reeds and one looks right across the expanse of open water. Seyoram is a peninsula on which is held a market to which the Budumas (the shy denizens of the lake) bring potash and dried fish to sell and in turn buy corn and cloth from the Kanuri and Kanembu." Mr. Tomlinson found these people comparatively friendly, and the parents were best reached through notice taken of their babies. He was much impressed with the extraordinary accuracy of Barth's descriptions of the country, which he was reading day by day as he passed through the same villages. In Barth's time however Seyoram was an island, and his attempts to reach it were unsuccessful.

Launch of German Steamer on Lake Tanganyika.

According to a note in the *Deutsches Kolonialblatt* for 1 August 1915, the *Götzen*, the first of the three large steamers intended to ply on Lake Tanganyika in connection with the Ujiji railway, had been launched at Kigoma on the east coast of the lake. The *Götzen*, which was laid down in 1913, is a twin-screw steamer 220 feet in length, with a draught of $7\frac{1}{2}$ feet when laden. Further details are given in the paper named, which also gives illustrations of the vessel while under construction.

AMERICA.

Changes on the Eastern Coast of the United States.

A popular account of some of the results of the battle of land and sea on the eastern coast of the United States, profusely illustrated by photographs, is given in the September number of the *National Geographic Magazine* by Mr. J. O. La Gorce. As is usual in this magazine the pictures are the part of the article most calculated to arrest attention, forming as they do a striking series both pictorially and as excellent examples of the common features of coast erosion. The letterpress brings together instances of changes in the coast-line in question within recent years, evidently in part from published sources, and it does not appear to what extent, if at all, the statements are the result of personal observation. The metaphor of a warfare between hostile forces is kept up throughout, perhaps with somewhat wearisome persistence, and the effects of the onslaught of the waves in wearing away the coast are forcibly described, with certain cases in which the victory has been, temporarily at least, on the other side. Among the points specially touched upon are Cape Henry, south of the entrance to Chesapeake Bay, where the old lighthouse built in 1791 on a hill washed by the sea is now left high and dry some distance

inland; the inner parts of Chesapeake Bay itself, the changes on whose shores have lately been studied with some care by Mr. J. F. Hunter (*Journal*, vol. 45, p. 160); the neighbourhood of Cape Cod, where the changes can be traced by the help of an elaborate map made in about 1715; and the outer coast of Long Island, where the Rockaway Bank is growing westward at the rate of nearly a mile every twenty years. The changes at the last-named are illustrated by a pair of sketch-maps showing the outlines in 1835 and 1908 respectively. Many of the illustrations exemplify the effects of the encroachment of wind-driven sand on the country behind the coast. In one case, that of Shackleford Bank, North Carolina, the sand comes inland at the rate of a quarter of a mile annually. In another, near Cape Henry, a dune is shown in process of crossing a small river, of which nearly half the bed has already been filled. The photo-gravure plates accompanying the paper are from studies by Mr. H. C. Mann.

The New York State Barge Canal.

This important undertaking, representing the old Erie Canal in reconstructed form, is the subject of a series of articles contributed last year by Mr. Wilfred H. Schoff to the *Bulletin of the American Geographical Society* (May, July, and August, 1915). They supply a useful sketch, first of the history and fortunes of the old Erie Canal; next of the steps taken within recent years to suit the old canal to modern requirements, and of the technical features of the new project; and lastly of the commercial effects to be anticipated from it when in full working. Opened to traffic in 1825, the record of the Erie Canal was one of continued and progressive usefulness down to about 1882, by which date the net profits to New York State were so large as to justify the abolition of tolls. But then followed a period of decline, due to the great improvement of railway facilities and the general change in the economic condition of the United States with the settlement of the great areas in the north-west. Between 1870 and 1898 New York failed to hold its own against the competition of other ports for the export of flour and grain, and the amount carried by the canal fell very considerably. It became a question on the one hand of greatly improving the canal, on the other of abandoning it altogether, the former alternative being finally decided on in 1903 by the New York State Legislature, which authorized the expenditure of a sum of $101,000,000. Work began in 1905 and has been so energetically prosecuted that the canal is now approaching completion. Mr. Schoff points out that though eclipsed in popular interest by the Panama Canal, in some of its commercial aspects the New York work will be of still greater importance, and that it "shows achievements second only in size to those at Panama, and in a far greater variety, including problems of waterway construction never before solved." While the excavation needed is more than half that at Panama, it can show "thirty-nine dams as against four at the isthmus; fifty-seven locks as against six, with an infinity of aqueducts, bridges, by-passes, spillways and other hydraulic structures not thought of at Panama." The new barge canal (of which about two-thirds will be new construction and one-third enlargement of the old canal) will provide navigation facilities for boats of about 3000 tons capacity (using full lock width) between New York on the one hand, and Lakes Champlain, Ontario and Erie on the other, the main line running nearly due west from Waterford on the Hudson to Tonawanda on the eastern branch of the Niagara River above the falls. The New York State project ends at Troy, a little below Waterford, where a great dam will be built, and below which the improvement of the Hudson has been undertaken by the Federal Government. As regards the prospects of the new canal, it is pointed out that much may be expected from local traffic, as

the canal passes through by far the most thickly populated parts of New York State. Although during the reconstruction through business has been at a standstill, the internal traffic has shown a gain of 50 per cent. in the past decade. But it is also an essential link in a much larger system, which will in time give possibilities of barge transport up and down the whole Atlantic seaboard from New England to Florida. The New York State Canal has been undertaken on the assumption of a probable traffic of 10,000,000 tons yearly, but its maximum capacity will be about double this figure, and it may be expected to rank among the world's busiest waterways.

Californian Earthquake of 22 June 1915.

The San Francisco earthquake of 1906 originated in a displacement along a great fault, or system of faults, known as the San Andreas rift. The movement was traced, with a few submarine interruptions, for a distance of 290 miles, from near Cape Mendocino to the east of Monterey Bay. The San Andreas rift, however, extends considerably farther to the south, having been followed, after a course of more than 600 miles, to the north end of the Colorado Desert. In the south-eastern corner of the state of California there are three parallel faults with a general south-easterly direction, one of which, the San Jacinto fault, may be a branch of the San Andreas rift. This fault passes, or appears to pass, under the Imperial Valley, and movements along it were probably the cause of the two strong earthquakes which occurred in that valley on 22 June 1915. The earthquakes were investigated by Mr. Carl H. Beal and described by him in the *Bulletin* of the Seismological Society of America (vol. 5, 1915, pp. 130–149). Though the information is somewhat scanty, Mr. Beal has drawn approximately the isoseismal lines corresponding to intensities 9—3 of the Rossi-Forel scale. The innermost isoseismal lines are elongated curves traversed almost axially by the San Jacinto fault. Owing to the thick covering of recent deposits in the Imperial Valley the displacement left no visible traces, in the form of fault-scarps, etc., at the surface. The two principal earthquakes, which occurred at about 8 and 9 p.m. on June 22, were of about the same strength (intensity 9) and originated in nearly the same region of the fault. The total area disturbed was about 50,000 square miles, the earthquakes being the strongest felt in California since the great earthquake of 1906.

Traffic of the Panama Canal.

An official handbook of the Panama Canal was issued last year and contains in small compass a large amount both of practical and general information. It treats of such matters as the distances saved by the use of the canal; of methods and regulations; of the chief constructional features; and lastly of the trade which passed through it during the first six months after its open ing. The tables of distances show that the greatest saving is, as might be supposed, between the Atlantic ports of the United States and those on the west coast of America, the maximum in this section exceeding 9000 nautical miles. To Eastern Asia and Australasia the saving is, of course, much less, though still considerable. From European ports to the west coast of America the maximum saving only slightly exceeds 6000 miles. The section dealing with the traffic that has passed through the canal is of special interest as permitting a comparison between actual results and the many forecasts made during its construction. At least 95 per cent. of the ships using the canal were travelling over four great trade routes, viz. that between the Atlantic and Pacific coasts of the United States; between the Pacific coast of North America and Europe; between the west coast of South America on the one hand and the Eastern

United States and Europe on the other; and between the Eastern United States and the Far East (including Australasia). The cargoes carried by the first route approached half a million tons in either direction during the first six months; the chief items on the eastward route being canned fruit and fish, lumber, wine, sugar, ores, etc., and on the return coal, structural iron, machinery, and the most varied merchandise. From the Pacific coast of North America to Europe, the total cargoes (of which one-half were grain) also approached half a million tons, but the return freights were only about one-seventh of this. From the west coast of South America the total cargoes exceeded 370,000 tons, by far the largest of them being nitrates; the return freights in this case too were very much smaller. From the United States to the Far East the total was 287,000 tons, made up of petroleum and petroleum products, raw cotton, and a great variety of manufactured goods. Only two vessels returned directly from the Far East through the canal. About one-third of all the goods which passed through were made up by the six items: grain, nitrates, coal, petroleum products, lumber and cotton. The total movement of cargo through the canal down to 1 April 1915 was at the rate of over 5,000,000 tons yearly, the average monthly amount being almost as much as that handled by the Panama railway in a complete year. It must be remembered, however, that the canal has been since closed to shipping owing to renewed landslides, and that its usefulness will be much curtailed until such difficulties are finally surmounted.

AUSTRALASIA AND PACIFIC ISLANDS.

Explorations in Northern New Guinea.

Two separate pieces of exploration carried out by German travellers before and during the Australian occupation of Kaiser-Wilhelmsland deserve mention. In the basin of the Sepik or Kaiserin Augusta Victoria River Dr. R. Thurnwald, a well-known ethnologist who had taken part in the expedition of the German Colonial Society to that part of the island, remained there after the rest of the party had left, and made various journeys both in the tract between the Upper Sepik and the north coast, and about the headwaters of the river beyond the farthest point reached by his predecessors. In this direction he came upon an extensive basin some 5000 feet or more above the sea, surrounded by higher ground and measuring some 25 miles by 12; it is watered by the Sepik and its branches, and is fairly well peopled, whereas the course of the Sepik lower down was through a very sparsely inhabited tract. It lies W.S.W. of the range marked on the maps as Victor Emanuel range; but this, Dr. Thurnwald says, is really to be found in the higher range further south, which must be the one seen by D'Albertis. Dr. Thurnwald was away on this journey at the outbreak of the war, and his base camp was reached by a British or Australian military party, who, according to letters from the traveller printed in the *Deutsches Kolonialblatt* (1 August 1915) and elsewhere, left again for the coast after waiting in vain for his return, and took with them his motor-boat and supplies, so that he had some difficulty in making his way back to the coast. At the opposite end of the territory an interesting journey through the Hinterland of Huon Gulf was made in 1913 by a German missionary named Pilhofer, who had already become known for good work of the kind in the eastern part of the German protectorate. His narrative, with a large-scale map based on his journals, is printed in the first two numbers of *Petermanns Mitteilungen* for 1915. Starting from the mouth of the Waria river, near the Anglo-German boundary (which it crosses and recrosses in its winding middle course), he penetrated the basin of this river almost to its

source, and then, striking north across a plateau 8000 feet in altitude, reached another river system which seems to be that of the Markham, the large stream which debouches at the head of Huon Gulf. This was eventually struck in its middle course, and the sea reached a little to the north of its mouth. The journey led through an area hitherto almost entirely unknown, and is thus of considerable interest. Since the Australian occupation something has been done by the new authorities to penetrate inland from the coast near Friedrich-Wilhelmshafen, and reports have been received of a short journey made by Lieut. Ogilvy from Madang inland among the Hansemann ranges, where the country as a rule is healthy. It is hoped that a road may be cut from the coast to the Ramu with a view to the opening up of the inland country.

Small Prospect of Petroleum Discoveries in South Australia.

The Report by Dr. Arthur Wade on the results of his recent examination of supposed oil-bearing areas in South Australia (Geological Survey of South Australia, Bulletin No. 4, 1915) is of a good deal of importance, if in a negative sense, as a corrective to the wild ideas often entertained as to the probability of petroleum occurrences by those without special knowledge of the principles involved. At the same time the researches carried out by him and his assistant, Mr. Wrathall, during five months' energetic travel in four different parts of the state, have added considerably to our knowledge of the geology of those areas. The fact that bituminous substances have been found in various parts of South Australia has led to continued search for petroleum by prospectors during the past fifty years, many licences having been issued by the Government for the purpose. Dr. Wade and his assistant covered some 10,000 miles of territory during their examination of the areas supposed to be likely to contain oil, the principal ones being (1) Eyre's Peninsula and the West Coast; (2) Kangaroo Island; (3) Yorke Peninsula; (4) the south-eastern district. Dr. Wade briefly outlines the conditions of the occurrence of petroleum generally, and points out how the experience of a trained geologist may obviate expenditure on enterprises foredoomed to failure. He describes the geological features of the different areas in turn, and shows that in almost all cases the necessary conditions are entirely wanting. Where porous strata which might serve as a reservoir exist they are capped by no impervious cover, and often form a mere shallow film resting horizontally on the older rocks below. In a part of the south-eastern district the position is somewhat different, but even here actual evidence of the occurrence of oil is altogether wanting, and Dr. Wade regards such occurrence as at best a faint possibility. A section of the report deals with some of the erroneous ideas held in South Australia (as in South Africa) on the subject, such as the confusion between oil-shales (containing substances capable of yielding oil by distillation) and oil-bearing rocks; the belief that the occurrence of salt pans or of marine fossils is a favourable indication; that extensive Tertiary formations are (apart from special conditions) likely to contain oil; or even that the general look of the surface may be a guide to the presence of oil. One result of Dr. Wade's work has been to show that the present surface cover of sands, travertine, alluvium, etc., is to a large extent but a thin sheet overlying an older landscape, which comes to the surface in places in the form of granite, gneisses, metamorphic or sedimentary rocks.

Fluctuations of the Franz Josef Glacier, New Zealand.

During the survey of this glacier in 1909 under the direction of Dr. J. Mackintosh Bell (*Journal*, vol. 38, p. 207), measures were taken to supply a basis for future study of changes in the position of the terminal face by the

fixing of pegs in position across it. Notes on the changes so far observed are now given in the *Transactions of the New Zealand Institute*, vol. 47, 1914, by Mr. R. Speight, to whom the observations were supplied by Mr. Alec Graham, a guide who lives in the neighbourhood. They show that in the interval since 1909 the face has retreated about 170 feet on an average, the distances at different parts of it varying from 120 to 350 feet. It seems that the survey was made at a time when the face showed signs of an extraordinary advance, and that the recent retreat represents the setting in of the contrary phase. There are indications, in a recent 20-foot rise of the glacier surface 2 miles above the face, that another advance may shortly be expected. The conditions appear to be much the same in the parallel Fox Glacier, 20 miles to the south.

POLAR REGIONS.

Meteorological Correlations in Antarctica.

Mr. R. C. Mossman, who has done prominent work in bringing to light numerous cases of correlation between meteorological elements in different, and often widely separated, parts of the world, has published in the *Proceedings of the Royal Society of Edinburgh*, vol. 35, Part II. (No. 20), an investigation on these lines entitled "On a See-Saw of Barometric Pressure, Temperature and Wind Velocity between the Weddell Sea and the Ross Sea." He shows how the "see-saw" is to be deduced from some sixteen seasons' records as derived from the various south polar expeditions, between M'Murdo Sound and Laurie Island, South Orkneys. As regards barometric pressure there are only three instances in which the deviation from the normal is characterized at the two stations by the same sign, viz. the summers of 1903–04 and 1911–12, and the autumn of 1912; and in the case of wind velocity only in the winter of 1911 and the spring of 1903 is the sign of the departures the same. With the temperature, however, the contrast between the two regions is only strongly marked in the winter period, its failure to appear in the summer being ascribed "to the relatively feeble Antarctic circulation then prevailing, there being at this time a levelling-up process due to the great transference of air from lower latitudes to the Antarctic Continent." It should be noted that neither Laurie Island nor M'Murdo Sound is situated in "action centres," since the South Orkneys are located some 300 miles north of the Weddell Sea barometric minimum, and M'Murdo Sound lies west-south-west of the Ross Sea minimum. It would appear, therefore, that we are really discussing a somewhat modified result of changes taking place, on the one hand, in the adjacent centres of cyclonic action, and on the other in the anticyclonic conditions on the Antarctic plateau, which is no doubt the controlling factor. The position of an anticyclonic area which normally covers the south of Graham's Land is also a prominent factor affecting Laurie Island, especially in late spring or early summer. At Evangelists Island, south of Tierra del Fuego, the seasonal variations of wind force agree with those recorded at M'Murdo Sound, the signs differing only in the winter of 1911, while they disagree with those at Laurie Island except in the spring of 1903. The above is a very brief statement of certain facts brought to light in the course of a much larger inquiry into the inter-relations between the meteorology of Antarctica and the southern continents, the results of which Mr. Mossman hopes soon to publish. Meanwhile one may congratulate him on the fruitful results of his application of the method of correlation to meteorological records, and need hardly point out the high potential value which attaches to a knowledge of the interdependence of the weather elements in different regions for the better understanding of the physics of the atmosphere.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Magnetic Survey of the Pacific Ocean.

The important work done during the past ten years under the Carnegie Institution of Washington for the magnetic survey of the great oceans has been frequently referred to in the *Journal*, but attention may be called to a general survey of the results attained in respect of the Pacific Ocean, contributed to the September number, 1915, of *Terrestrial Magnetism* by Dr. L. A. Bauer and Mr. W. J. Peters. Before the Carnegie Institution inaugurated the work in 1905 the Pacific was practically a blank as regards magnetic observations, and even for the other oceans nothing definite was known as to the extent of the errors supposed to exist in the charts. The voyages of the survey vessels *Galilee* and *Carnegie* have since covered the Pacific with a network of tracks crossing and recrossing each other at a number of points, and so affording the means of determining the rate of change of declination now in progress by a comparison of the observations at the same spot at intervals of several years. The *Carnegie*, whose new voyage begun in 1915 was referred to in the *Journal*, vol. 45, p. 342, is still at work in the Pacific, having proceeded from Panama to Alaska, and thence to Port Lyttelton, New Zealand, with a view to beginning the circumnavigation of the globe in latitudes between 55° and 60° S. The previous tracks of the two vessels will be intersected as often as possible, and it is expected that the Pacific work will be completed by the end of this year. Altogether the two ships will have covered about 136,000 nautical miles in the Pacific, and the number of observations for declination and dip in this ocean already number nearly 700 and 600 respectively. Through the work already done the magnitude of the corrections to charts of declination and their distribution in the Pacific are now known, and are illustrated by a diagram in the paper under notice. Generally speaking the corrections to the British, American, and German charts are of about the same order of magnitude and sign. All the large positive corrections occur in an area roughly bounded by 150° W. long., the coast of North America, and a line drawn from Panama to the intersection of 50° S. with 150° W.; the maximum corrections of over +2° being near the south apex of this triangle. The largest negative corrections occur in two separate regions, on either side of the area of positive corrections, the maximum of about −2°·4 being found in a high latitude south of the Aleutian Islands. The corrections are to be added algebraically to the values given in the charts, east declination being regarded as positive; and it may be noted that as the declination is almost entirely east throughout the area under consideration, the positive corrections will nearly always imply that the chart values are too low, the negative that they are too high. The effect of the negative corrections on the borders of the area of westerly declination in the extreme north-west will be to shift the line of no variation somewhat to the east, the actual values being increased or diminished according as they lie west or east of that line. The authors also give a table showing the average annual *change* in declination for a dozen localities as determined by the survey, the British and American chart values being given for comparison; and another shows the corrections for dip and horizontal intensity to be applied to the values in the British and German charts respectively. The dip corrections in a considerable number of cases exceed 5°, the maxima being positive in the case of the German, negative in the case of the British charts.

OBITUARY

The Archduke Ludwig Salvator.

THE death has been announced of the Archduke Ludwig Salvator of Austria, known for his sumptuously produced works descriptive of Mediterranean countries and localities, as well as some minor narratives of travel. His biggest undertaking was the production, in ten huge folio volumes, of an illustrated account of the Balearic Islands, which appeared at intervals between 1869 and 1891 under the title 'Die Balearen in Wort und Bild,' and is the most exhaustive description of the islands ever attempted. This was followed in 1893-95 by a smaller but still imposing work of a similar kind on the Lipari Islands, and later volumes dealt with various islands and coast towns of the Mediterranean, from Spain to Greece, and from Italy to North Africa. All were brought out at his own expense and liberally distributed to geographical and other libraries, our own included. The Archduke had residences at Zindis near Trieste, and on the island of Mallorca. He had been an Honorary Fellow of this Society since 1880.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1915-1916.

Second Evening Meeting, 29 November 1915.—The President in the Chair.

ELECTIONS.—Emile Michael John de Abrew Abeyesinhe; Robert Anderson; Frederick Langford Baldwin; Harry George Bateman; Captain L. V. S. Blacker, Queen Victoria's Own Corps of Guides (Lumsden's) Frontier Force, I.A.; Edmund Johnson Boake; Rev. Ernest Frank Borst-Smith; Joseph Barrett Brandreth; Ernest Henry Butcher; Norman Beckett Coster; Rev. Frederick G. L. Cruce, R.N.; John Ghest Cumming; Leonard B. Cundall; Lieut. R. B. Dent, 3rd Q.A.O. Gurkha Rifles, I.A.; Monsieur V. Willemoes d'Obry; Captain Charles Eddie; William Allan Elliott; G. R. Footner, M.B., F.R.C.S.; Lieut.-Colonel Rev. William E. Gillan; Joseph Clarke Grew; John Alexander Hammerton; Lieut. John de Vars Hazard, R.E.; George William Hill; Herbert Howland; Charles R. Hyde; Le Roy Jeffers; Lieut. Walter Willson Jervis, 4th Devon Regt.; Banner Carruthers Johnstone, B.A.; George Richard Lancefield; Lieut. John Meikle Legate; William John Macintyre Mackenzie; Henry Vere Macmaster; Lieut. Louis William G. Malcolm, R.G.A.; Miss A. E. Irene Moseley, B.Sc.; Lieut. William Robert Patterson; Henry Clemens Pearson; William Charles Rose; Lieut. Edward Owen Rutter; Captain M. R. Strover, R.A.; Mrs. Geoffrey Tomes; Captain John Elmsley B. Torkington, I.A.; Miss Gladys M. Wauhope; Lionel Seymour Wells; Captain Paul Westergaard, Danish Royal Engineers; Edward Aldred Williams; Rev. John Wood.

PAPER: The Railway Development of Africa, Present and Future. Sir Charles Metcalfe, Bart.

Third Evening Meeting, 13 December 1915.—Major Leonard Darwin, Vice-President, in the Chair.

ELECTIONS.—Frederick W. Abbot; Lieut.-Colonel Ernest Washington Chance, R.A.; Lieut. H. T. Curtis; Commander W. Hawkes-Strugnell; Lieut. H. L. Manderson, 11th Battn. North Lancs. Regiment; Miss Elsie Miles.

PAPER: The Work of the Peru-Bolivia Boundary Commission. Colonel Sir Thomas H. Holdich.

Second Afternoon Meeting, 16 December 1915.—Dr. J. S. Owens in the Chair.

PAPER: The Nature and Formation of Sand Ripples and Dunes. W. J. Harding King.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY.

Edward Heawood, Librarian, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (Mét.) = Meteorological.
P. = Proceedings.
R. = Royal, Reale, etc.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab, etc.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Communications. **Scheffel.**

Verkehrsgeschichte der Alpen. II. Band. Das Mittelalter. Von P. H. Scheffel. Berlin: D. Reimer, 1914. Size 10 × 7½, pp. viii. and 298. *Price* 15*s.*

An important work, the first volume of which appeared in 1908. The two will now be reviewed together.

Alps—Historical. **Coolidge.**

The passages of the Alps in 1518. By W. A. B. Coolidge. (Reprinted from the *English Historical Review*, October, 1915.) Size 10 × 6½, pp. 681–691.

Albania—Travel. **Baldacci.**

B.R.S.G. (*Rome*), Ser. V. 4 (1915): 925–958, 1020–1044, 1141–1180, 1214–1250.

Itinerari albenese del 1896 [1897]. By Antonio Baldacci. *Illustrations.*

Austria—Bohemia. *B.S.G. Com. Paris* 37 (1915): 215–224. **Crkal.**

La Bohême économique. By V. Crkal. *Map.*

Austria and Italy—Frontier zone. **Battiste.**

Dott. Cesare Battisti. Il Trentino, cenni geografici, storici, economici, con un' appendice su l'Alto Àdige. Novara: Istituto Geogr. de Agostini, 1915. Size 10 × 6½, pp. 54. *Maps. Price* 3*s.* 6*d.*

Balkan Peninsula. *B.G.S. Philadelphia* **13** (1915): 155–160. **Waldo.**
New Balkan Geography. By Fullerton L. Waldo. *Illustrations.*

Belgium—Early cartography. *G.Ts.* **23** (1915): 108–111. **Schütte.**
Et maskeret Belgienskort hos Ptolemaios. Af Dr. Gudmund Schütte. *Facsimiles.*

Europe—War and Weather. *J.G.* **14** (1915): 71–76. **Ward.**
The weather factor in the great war. III. By Robert De C. Ward.

Greece—Language. **Thimm.**
Greek self-taught (Modern), with phonetic pronunciation. (Thimm's system.) By Nicolaos Anastassiou. 2nd edit. London: Marlborough & Co., 1915. Size 7½ × 5, pp. 120. *Price 2s. 6d. Presented.*
Likely to be of much use under existing circumstances.

Holland—Nijmegen—Geology. **Tesch.**
Ts. Kon. Nederl. Aardr. Gen., 2 Ser. **32** (1915): 569–574.
Toelichting bij een geologische kaart van het Rijk van Nijmegen met het aangrenzend gebied. Door P. Tesch. *Map.*

Mediterranean—Oceanography. *B.R.S.G.* (*Madrid*) **57** (1915): 515–526. **Buen.**
Segunda campaña oceanográfica del "Vasco Nunez de Balboa." Por D. Odón de Buen.

Russia. **Friederichsen.**
Die Grenzmarken des Europäischen Russlands, ihre geographische Eigenart und ihre Bedeutung für den Weltkrieg. Von Dr. Max Friederichsen. Hamburg: L. Friederichsen & Co., 1915. Size 9½ × 6, pp. 148. *Price 5s.*

Spain—Osma. *B.R.S.G. Rev. G. Col. y Merc.* (*Madrid*) **12** (1915): 377–400. **Becerra**
Osma.—Monografía geográfica. Por Luis Linares Becerra.

Spain—Segovia—Zamarramala. **Chico y Rello.**
B.R.S.G., Rev. G. Col. y Mercantil (*Madrid*) **12** (1915): 337–361.
Zamarramala.—Monografía geográfica. Por Pedro Chico y Rello. *Sketch-map and Illustrations.*

Sweden—Economic geology. **Hedström.**
Sveriges Geol. Undersökning, Årsbok **8** (1914): No. 5, pp. 197.
Om Sveriges produktion och konsumption av kalksten, kalk, krita och dolomit försök till en statistik för åren 1908, 1909, 1910 och 1911. Av Herman Hedström.

Sweden—Scania—Geology. **Grönwall.**
Sveriges Geol. Undersökning, Årsbok **8** (1915): No. 2, pp. 185.
Nordöstra Skånes kaolin- och kritbildningar samt deras praktiska användning. Av Karl A. Grönwall. *Maps and Illustrations.*

Turkey—Language. **Thimm.**
Turkish self-taught with English phonetic pronunciation. By Captain C. A. Thimm. Revised by Prof. G. Hagopian. 4th edit. London: Marlborough & Co., 1910. Size 7½ × 5, pp. 140. *Price 2s. 6d. Presented.*
One of Marlborough's handy series for self-instruction in foreign languages, which has proved invaluable to travellers.

United Kingdom—Aberdeen—Archæology. **Fraser.**
Scottish G. Mag. **31** (1915): 561–567.
The Roman camp near Aberdeen. By G. M. Fraser. *Map and Illustrations.*

United Kingdom—England—Roads. **Fordham.**
Roads and travel before railways in Hertfordshire and elsewhere . . . By Sir Herbert George Fordham. (From the *Trans. of the Hertfordshire Nat. Hist. Soc.*, vol. **16**, pt. 1.) Hertford, 1915. Size 9 × 5½, pp. 36. *Facsimiles. Presented.*

United Kingdom—Geographical research. **Fleure and Whitehouse.**
Suggestions for investigations in human geography in Britain. By Dr. H. J. Fleure and W. E. Whitehouse. Aberystwyth, N.D. Size 9½ × 6, pp. 28. *Presented by the Authors.*
The suggestions will supply an excellent and much-needed guide to students desirous of taking up original research in geography.

United Kingdom—Ice Age. **Holst.**
Geol. Mag., Dec. VI. **2** (1915): 418–424, 434–444, 504–513.
The Ice Age in England. By Dr. Nils Olof Holst.

United Kingdom—Inverness. *Scottish G. Mag.* **31** (1915): 589–596. **Bremner.**
The capture of the Geldie by the Feshie. By Alex. Bremner. *Illustrations.*

United Kingdom—Physical geography. **Bonney.**
On certain channels attributed to overflow streams from ice-dammed lakes. By T. G. Bonney. Cambridge: Bowes & Bowes, 1915. Size 8½ × 5½, pp. 44. 1*s. net.*

United Kingdom—Scotland—Floods. ——
Symons's Met. Mag. **50** (1915): 138–139.
Floods in the North-East of Scotland.

ASIA.

Ceylon—Archæology. *Spolia Zeylanica* **10** (1914): Pt. 36: 54–68. **Hartley.**
On the occurrence of pigmy implements in Ceylon. By C. Hartley. *Illustrations.*

Ceylon—Desert tracts. *Spolia Zeylanica* **10** (1915): 166–174. **Wayland.**
Notes concerning the occurrence of small desert tracts in the north-west of Ceylon. By E. J. Wayland. *Map and Illustrations.*

Ceylon—Marine biology. **Pearson.**
Ceylon. Administration Reports, 1914. Part IV.—Marine biology. Report of the Government marine biologist [Joseph Pearson]. N.P., N.D. Size 13½ × 8½, pp. 23. *Illustrations.*

Ceylon—Ornithology. *Spolia Zeylanica* **10** (1914): Pt. 36: 1–32. **Wait.**
The distribution of birds in Ceylon and its relation to recent geological changes in the island. By W. E. Wait.

Ceylon—Vedda country. *Spolia Zeylania* **10** (1915): 119–165. **Lewis.**
Notes on animal and plant life in the Vedda Country. By F. Lewis. *Map.*

Dutch East Indies—Java. *B.R.S.G.* (*Rome*), Ser. V. 4 (1915): 1045–1077. **Piscicelli.**
A Giava. By Maurizio Piscicelli. *Illustrations.*

India—Survey. **Burrard.**
Survey of India. General Report, 1913–14. From 1 October 1913 to 30 September 1914. Prepared under the direction of Colonel Sir S. G. Burrard. Calcutta, 1915. Size 14 × 8½, pp. 38. *Maps. Price* 2 *rupees or* 3*s.*

India—Travel. **Hamilton.**
Through wonderful India and beyond. By Norah Rowan Hamilton. London: Holden & Hardingham, 1915. Size 9 × 5½, pp. 310. *Illustrations. Price* 12*s.* 6*d. net. Presented.*

Japan. **Porter.**
Japan, the New World-power. Being a detailed account of the progress and rise of the Japanese Empire. By Robert P. Porter. London: H. Milford, 1915. Size 9½ × 6, pp. xxiv. and 790. *Maps. Price* 6*s. net. Presented.*

A new edition of the same author's 'Full Recognition of Japan,' reviewed in vol. 39, p. 270. In the new preface it is pointed out how quickly and fully the views expressed in the earlier edition have been justified by recent events.

Japan—Formosa. **Campbell.**
Sketches from Formosa. By Rev. W. Campbell. London: Marshall Brothers, [1915]. Size 8½ × 5½, pp. 394. *Map and Illustrations. Price* 6*s. Presented.*

Malay Archipelago—Borneo. **Kemmerling.**
Ts. K. Nederl. Aardr. Gen., 2 Ser. **32** (1915): 575–642, 717–774.
Topografische en geologische beschrijving van het stroomgebied van de Barito. Door G. L. L. Kemmerling. *Map and Illustrations.*

Malay Archipelago—Java—Meteorology. **Braak.**
Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen. No. 3. Drachen- Freiballon- und Fesselballonbeobachtungen. Von Dr. C. Braak. Batavia, 1915. Size 10½ × 7½, pp. 58. *Illustrations.*

Malay Archipelago—Nomenclature. **Rouffaer.**
Ts. K. Nederl. Aardr. Gen., 2 Ser. **32** (1915): 642–649.
Oud-Javaansche eilandnamen in de Groote Oost. Door G. P. Rouffaer.
Discusses the names Sergili (Western New Guinea), Seram, and Buru.

Philippine Islands—Artesian wells. **Pratt.**
Philippine J. Sc. **10**, Sec. A (1915): 231–239.
The location of artesian wells in the Philippine Islands from a geologic view-point. By Wallace E. Pratt.

Philippine Islands—Geology. *Philippine J. Sc.* **10**, Sec. A (1915): 177–211. **Smith.**
Notes on a geologic reconnaissance of Mountain Province, Luzon, P.I. By Warren D. Smith. *Sketch-map and Illustrations.*

Western Asia—War theatre. *G.Z.* **21** (1915): 483–496. **Frech.**
Die Kriegsschauplatz der türkisch-persischen Grenze und seine Erdölvorkommen. Von Dr. F. Frech. *Illustrations.*

AFRICA.

Egypt—Political. *R. Col. I.J.*, New Ser., **6** (1915): 726–736. **Bell.**
The destiny of Egypt. By H. T. Montague Bell. *Illustrations.*

Gold Coast—Historical. **Claridge.**
A history of the Gold Coast and Ashanti from the earliest times to the commencement of the twentieth century. By W. Walton Claridge. With an introduction by Sir Hugh Clifford. 2 vols. London: J. Murray, 1915. Size 9½ × 6¼, pp. (vol. 1) xxxii. and 650; (vol. 2), xiv. and 638. *Maps. Price* 36*s. net. Presented.*

Morocco—Ceuta—Historical. **Roma du Bocage.**
Sociedade de Geographia de Lisboa. Boletim Comemorativo do V. Centenario da tomada de Ceuta. Étude préliminaire sur la prise de Ceuta par les Portugais—le 21 Août 1415, par le Général C. Roma du Bocage. Lisbon, 1915. Size 10 × 6½, pp. 15–34.

Morocco—Ceuta—Historical. **Vasconcellos.**
Sociedade de Geographia de Lisboa. Boletim Comemorativo do V. Centenario da tomada de Ceuta. Uma planta de Ceuta de 1774 por Ernesto de Vasconcellos. Lisbon, 1915. Size 10 × 6½, pp. 35–43. *Plan and Illustrations. Also separate Copy.*
See note in the December number, vol. **46**, p. 474.

Portuguese East Africa—Tete. *B.S.G. Lisboa* **33** (1915): 137–161. **Carrilho.**
Sobre as principais necessidades do distrito de Tete. (Conferencia realizada na Sociedade de Geografia em 11 de maio de 1914, pelo capitão J. L. Carrilho.)

South Central Africa. *B.S.G. Lisboa* **33** (1915): 181–208. **Coutinho.**
Impressões das duas viagens através d'África entre Angola e Moçambique. By Gago Coutinho.

South-West Africa. **Eveleigh.**
South-West Africa. By William Eveleigh. London: T. Fisher Unwin, 1915. Size 7½ × 5½, pp. viii. and 260. *Price* 5*s. net. Presented.*

Uganda—Ethnology. **Roscoe.**
The Northern Bantu. An account of some Central African tribes of the Uganda Protectorate. By John Roscoe. Cambridge: University Press, 1915. Size 8½ × 5½, pp. xii. and 306. *Sketch-map and Illustrations. Price* 12*s.* 6*d. net. Presented.*
See review in the present number, p. 56.

West and Central Africa—Meteorology. **Chudeau.**
C.R.A. Sc. (*Paris*) **161** (1915): 351–354.
La pression atmosphérique en Afrique occidentale et équatoriale. By R. Chudeau.

NORTH AMERICA.

Canada—Alberta. *T.R.S. Canada*, Ser. III. **9** (1915): 27–43. **Dowling.**
The Cretaceous sea in Alberta. By D. B. Dowling. *Maps.*

Canada—Quebec—Ethnology. **Speck.**
Canada, Geol. Surv., Mem. **70** and **71** (1915): pp. 30 and 87.
Family hunting territories and social life of various Algonkian bands of the Ottawa Valley. Myths and folk-lore of the Timiskaming Algonquin and Timagami Ojibwa. By F. G. Speck. *Map.*
Only two groups are in question, the designations being double.

Canada—Quebec—Geology. **Kindle and Burling.**
Canada, Geol. Surv., Museum B. No. 18 (1915): pp. 23.
Structural relations of [illegible]e-Cambrian and Palæozoic rocks north of the Ottawa and St. Lawrence Vall[illegible] By E. M. Kindle and L. D. Burling. *Maps and Illustrations.*

Canada—Saskatchewan Valley. **Kindle.**
Canada, Geol. Surv., Museum B. No. 21 (1915): pp. 25.
Notes on the geology and palæontology of the lower Saskatchewan River Valley. By E. M. Kindle. *Illust[illegible]ions.*

Canada and Alaska. **Cairnes.**
Canada, Geol. S[illegible]v., Mem. 67 (1914): pp. iii + 161 + vi.
The Yukon-Alaska Interna[illegible]onal boundary between Porcupine and Yukon rivers. By D. D. Cairnes. *Ma[illegible] l Illustrations.*
The first systematic geological investigation of most of the country in review. The memoir includes notes on the climate and general physical geography.

Canada and Alaska—Historical. *T.R.S. Canada*, Series III. 9 (1915): 65–77. **White.**
Treaty of 1825—Correspondence respecting the boundary between Russian America (Alaska) and British North America. By James White.

Mexico—Cozumel Island. *B. Pan-American Union* 41 (1915): 221–236. ———
Cozumel, a Mexican Island. *Illustrations.*

Mexico and Texas—Geology. *J. Geology* 22 (1915): 481–498. **Dumble.**
Some events in the Eogene history of the present coastal area of the Gulf of Mexico in Texas and Mexico. By E. T. Dumble. *Map.*

North America—Historical. **Crockett and Wallis.**
North America during the eighteenth century. A geographical history. By T. Crockett and B. C. Wallis. Cambridge: University Press, 1915. Size 8 × 5½, pp. vi. and 116. *Sketch-map and Illustrations. Price 3s. net. Presented.*

North America—Lake Superior Highlands. *J. Geology* 22 (1915): 569–574. **Keyes.**
Lake Superior highlands: their origin and age. By Charles Keyes. *Illustrations.*

United States—Arizona. *B. American G.S.* 47 (1915): 561–577, 652–672. **Gregory.**
The Navajo country. By Herbert E. Gregory. *Maps and Illustrations.*

United States—California—Earthquake. **Beal.**
B. Seismolog. S. America 5 (1915): 130–149.
The earthquake in the Imperial Valley, Cal., 22 June 1915. By Carl H. Beal. *Maps and Illustrations.*

United States—Climatology. *B. American G.S.* 47 (1915): 672–680. **Ward.**
Climatic subdivisions of the United States. By Robert de C. Ward. *Maps.*

United States—Geographical work. **Bryant.**
H. G. Bryant. The record of the United States in geography 1889–1913. (From X. Congreso Internazionale di Geografia, 1913.) Rome, 1914. Size 10¼ × 7, pp. 40. *Presented.*

United States—Minneapolis. *J. Geology* 22 (1915): 444–460. **Soper.**
The buried rock surface and pre-glacial river valleys of Minneapolis and vicinity. By E. K. Soper. *Map and Illustrations.*

United States—New Mexico. **Wooton and Standley.**
Smithsonian I., U.S. National Museum 19 (1915): pp. 792.
Flora of New Mexico. By E. O. Wooton and Paul C. Standley.

United States—Pennsylvania—Geology and Economics. **Rolfe.**
B.G.S. Philadelphia 13 (1915): 133–154.
Geologic influences in the economic development of the Pennsylvania Piedmont Plateau. By Deete Rolfe. *Sketch-maps and Illustrations.*

United States—Phytogeography. *G. Ts.* 23 (1915): 83–108. **Paulsen.**
Den internationale plantgeografiske Ekskursion i America 1913. Af Dr. Ove Paulsen. *Sketch-map and Illustrations.*

United States—Utah—Rivers. *American J. Sc.* 40 (1915): 314–316. **Anderson.**
Stream piracy of the Provo and Weber rivers, Utah. By G. E. Anderson. *Sketch-maps.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *J. B. American G.S.* **47** (1915) [illegible]. **Willis.**
Argentina and the Argentines. By Bailey Willis.

Argentine—Rio Negro. *B. Pan-American Union*, **41** (1915): 345–362. **Fischer.**
The Valley of the Rio Negro—Argentine Republic. By Walter Fischer. *Illustrations.*

Brazil—Minas Geraes—Geology. **Harder and Chamberlin.**
J. Geology **22** (1915): 341–379, 385–424.
The geology of Central Minas Geraes, Brazil. Parts I. and II. By E. C. Harder and R. T. Chamberlin. *Sketch-maps and Illustrations.*

Panama. *National G. Mag.* **28** (1915) [illegible]. **Shiras.**
Nature's transformation at Panama. By George Shiras. *Illustrations.*

Panama Canal. ——
Official Handbook of the Panama Canal, 1915. Washington, 1915. Size 9 × 6, pp. 58. *Map and Illustrations.*
See note in the Monthly Record, *supra.*

Peru—Altitudes. *B.S.G. Lima* **30** (1914): 118–119. **Mailles.**
Cuadro de diferencias de altura de Tirapata á Puerto Maldonado. Por C. Mailles.

Peru—Distances. *B.S.G. Lima* **30** (1914): 120–134. **Llona.**
Cuadro de distancias de Lima á las capitales de provincia. By Scipión E. Llona.

Peru—Districts. *B.S.G. Lima* **30** (1914): 52–74. ——
Indice alfabético de los distritos de la República.

Peru—Madre de Dios. *B.S.G. Lima* **30** (1914): 139–187. **Portillo.**
Departamento del Madre de Dios. Memoria que presenta el coronel D. Pedro Portillo. *Illustrations.*

Peru—Railway. *B.S.G. Lima* **30** (1914): 188–213. **Muro.**
El gran ferrocarril del norte. Por A. Mesones Muro.

Peru—Survey. *B.S.G. Lima* **30** (1914): 107–114. **Portocarrero.**
Comisión hidrológica de la Libertad. Triangulación del valle de Chicama por Juan N. Portocarrero y C. Por Juan N. Portocarrero.

West Indies—Historical. *Rev. Histoire Colonies Françaises* **3** (1915): 289–354. **Cultru.**
Colonization d'autrefois: le Commandeur de Poincy à Saint-Christophe. By P. Cultru.
On a French colonizing enterprise in the early seventeenth century.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Year Book. **Knibbs.**
Official year book of the Commonwealth of Australia. Containing authoritative statistics for the period 1901–1914 and corrected statistics for the period 1788 to 1900. No. 8, 1915. By G. H. Knibbs. Melbourne, [1915]. Size 9½ × 6, pp. xl. and 1128. *Maps and Diagrams. Presented.*

New Guinea—Dutch—Ethnology. ——
Ts. K. Nederl. Aardr. Gen., 2 Ser. **32** (1915): 655–672.
Ethnographische gegevens betreffende de inboorlingen in het stroom-gebied van de Mamberamo.

Pacific Islands—Coral reefs. *American J. Sc.* **40** (1915): 223–272. **Davis.**
A Shaler Memorial study of coral reefs. By W. M. Davis. *Illustrations.*
Reference to Prof. Davis's researches was made in vol. **45**, p. 539.

Pacific Ocean—Magnetism. **Bauer and Peters.**
Terrestrial Magnetism, etc. **20** (1915): 95–103.
General Results of the Magnetic Survey of the Pacific Ocean. By L. A. Bauer and W. J. Peters. *Map.*
See note in the Monthly Record, *supra*, p. 68.

South Australia—Petroleum. *Geol. Surv. South Australia*, B. 4 (1915) : pp. 53. **Wade.**
The supposed oil-bearing areas of South Australia. Investigations by Arthur Wade. *Maps and Illustrations.*
Noticed in the Monthly Record, *supra*, p. 66.

POLAR REGIONS.

Arctic—Crocker Land Expedition. **Macmillan.**
Harper's Monthly Mag. 131 (1915) : 651–665, 921–930.
In search of a new land. By Donald B. Macmillan. *Map and Illustrations.*
Account of the sledge journey over the ice in search of Crocker Land (*Journal*, vol. 45, p. 252 ; 46, p. 67).

Arctic—Eskimo. **Porsild.**
The principle of the screw in the technique of the Eskimo. By Morten P. Porsild. (From the *American Anthropologist*, [N.S.], vol. 17, 1915.) Lancaster, Pa., 1915. Size 10 × 6½, pp. 16. *Illustrations.*

Greenland—Eskimo. **Porsild.**
Studies on the material culture of the Eskimo in West Greenland. By Morten P. Porsild. Arbejder fra den Danske Arktiske station paa Disko. Nr. 7. (Særtryk af *Meddelelser om Grønland*, LI.) Copenhagen, 1915. Size 11 × 7, pp. 114–250. *Illustrations.*

Greenland—Magnetism. *Meddelelser om Grønland* 42 (1915) : 595–631. **Brückmann.**
Magnetische Beobachtungen der Danmark-Expedition. Von W. Brückmann. *Illustrations.*

Greenland—Nature protection. **Porsild.**
Naturfredning i Dansk Grønland. Arbejder fra den Danske Arktiske station paa Disko. Nr. 8. By Morten P. Porsild. (Særtryk af *Meddelelser om Grønland*, LI., 253–263.) Copenhagen, 1915. Size 11 × 7, pp. 10. *Illustrations.*
Concerned chiefly with the vegetation. A list of plants of southern type occurring about Engelsmandens-Havn is appended.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Cosmical Physics. *Sc. Monthly* 1 (1915) : 1–17. **Campbell.**
The evolution of the stars and the formation of the earth. By William Wallace Campbell. *Illustrations.*

Geology. *Science* 42 (1915) : 450–452. **Johnson.**
A proposed classification of the attitude of geologic surfaces. By Roswell H. Johnson.

Geomorphology—Rivers. **Ahlmann.**
Sveriges Geol. Undersökning, Årsbok 8 (1914) : No. 3, pp. 75.
Beitrag zur Kenntnis der Transportmechanik des Geschiebes und der Laufentwicklung des reifen Flusses. Von Hans W:son Ahlmann. *Illustrations.*

Geophysics. *P. American Philos. S.* 54 (1915) : 279–308. **Chamberlin and others.**
Symposium on the Earth : Its figure, dimensions, and the constitution of its interior. I. The Interior of the Earth from the view-point of geology. By T. C. Chamberlin. II. Constitution of the interior of the Earth as indicated by seismological investigations. By Harry Fielding Reid. *Diagram.* III. The Earth from the geophysical standpoint. By John F. Hayford.

Oceanography—North Atlantic. **Jacobsen.**
Meddelelser Kommiss. Havundersøgelser, Serie Hydrografi 2 (1915) : Nr. 4, pp. 47.
Hydrographical Investigations in Færoe Waters. Cruise of the M/S *Margrethe* in 1913. By J. P. Jacobsen. Copenhagen, 1915. Size 13 × 10½, pp. 47. *Illustrations.*

Seismology and Geology. *B. Seismolog. S.* 5 (1915) : 150–154. **Ballore.**
A Problem in seismological geology. By Count de Montessus de Ballore. *Sketch-map and Illustrations.*

Soils. **Russell.**
A student's book on soils and manures. By Dr. E. J. Russell. Cambridge : Uni-

versity Press, 1915. Size 8 × 5½, pp. vi. and 206. *Illustrations and Diagram. Price 3s. 6d. Presented.*

Includes a discussion of the influence of climate and other physical factors on soils.

Zoogeography—Plaice. **Johansen.**

Meddelelser Kommissionen Havundersøgelser, Serie Fiskeri 4 (1915): Nr. 9, pp. 60.

Contributions to the biology of the plaice, with special regard to the Danish plaice-fishery. VII. Marking experiments with plaice in the North Sea off the west coast of Jutland during the years 1906–1912. With supplementary observations on the previous Danish experiments. By A. C. Johansen. Copenhagen, 1915. Size 13 × 10½, pp. 59. *Sketch-maps and Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Archæology. **Parkyn.**

An introduction to the study of Prehistoric Art. By Ernest A. Parkyn. London: Longmans, Green & Co., 1915. Size 9 × 6, pp. xviii. and 350. *Maps and Illustrations. Price 10s. 6d. net. Presented.*

Economic—Cables. *G.Z.* 21 (1915): 496–515. **Schmitthenner.**

Das Weltkabelnetz. Von Heinrich Schmitthenner.

Historical—Prince Henry the Navigator. **Eça.**

Sociedade de Geographia de Lisboa. Boletim comemorativo do V. Centenario do tomada de Ceuta. Ainda a Escola de Sagres. Por Vicente Almeida d'Eça. Lisbon, 1915. Size 10 × 6½, pp. 63–87.

On the supposed school of navigation instituted by Prince Henry at Sagres.

History of Cartography. *Scottish G. Mag.* 31 (1915): 580–589. **Schütte.**

Ptolemy's Atlas: Fifth article. By G. Schütte. *Illustrations.*

Historical—Engraving in England. **British Museum.**

Early engraving and engravers in England (1545–1695). A critical and historical essay by Sidney Colvin. Published by order of the Trustees of the British Museum. London, 1905. Size 20½ × 15, pp. viii. and 170. *Illustrations and Forty-one Facsimiles. Price 10s. Presented by the Trustees of the British Museum.*

Has a good deal to do with early British cartography. (See review in the present number, p. 59.)

History of Geography. **Heidrich.**

Das geographische Weltbild des späteren englischen Mittelalters mit besonderer Berücksichtigung der Vorstellungen Chaucer's und seiner Zeitgenossen. Von Käte Heidrich. Freiburg im Breisgau: Hammerschlag & Kahle, 1915. Size 8½ × 5½, pp. 126.

BIOGRAPHY.

Strathcona. **Willson.**

The Life of Lord Strathcona and Mount Royal (1820–1914). By Beckles Willson. London: Cassell & Co., 1915. Size 10 × 6½, pp. xvi. and 632. *Sketch-map, Portraits, and Illustrations. Price 25s. net. Presented.*

Watts. *Geol. Mag.*, Dec. VI. 2 (1915): 481–487. ——

Eminent living geologists: Prof. William Whitehead Watts. *Portrait.*

GENERAL.

Congress—Report. ——

Atti del X. Congresso Internazionale di Geografia. Rome: Reale Società Geografica, 1915. Size 10½ × 7, pp. ccxxii. and 1548. *Maps and Illustrations. Presented.*

Geography. **Telles.**

O conceito scientifico da geografia. By Silva Telles. (Separata da *Revista da Universidade de Coimbra*, vol. 4, No. 1.) Coimbra, 1915. Size 11 × 7½, pp. 32.

Mountaineering—Bibliography. ——

The New York Public Library. Selected list of books on mountaineering. New York, 1914. Size 6 × 4, pp. 15.

Tropical Sanitation. **Watson.**

Rural sanitation in the Tropics, being notes and observations in the Malay Archipelago, Panama, and other lands. By Dr. Malcolm Watson. London: J. Murray, 1915. Size 9 × 5½, pp. xvi. and 320. *Sketch-map and Illustrations. Price 12s. net. Presented.*

NEW MAPS AND PHOTOGRAPHS: ADDITIONS TO THE MAP ROOM.

E. A. Reeves, Map Curator, R.G.S.

EUROPE.

Balkan Peninsula. **Berger-Levrault.**

Belgrade—Salonique, Sofia—Constantinople. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. Size 30 by 40 inches. Nancy : Berger-Levrault, [1915].

A somewhat diagrammatic map including Serbia, Bulgaria, European Turkey and Southern Rumania.

Europe. **Langhans.**

Die Ostsee als germanisches Meer. Entworfen von Paul Langhans. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Size 13 by 11 inches. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafel 18.—Die italienischen Grenzansprüche in den österreichischen Alpenländern auf ethnographischer Grundlage. Entworfen von Paul Langhans. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Size 13 by 22 inches. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafel 32.—Der rumänische Volksboden und die staatliche Entwicklung des Rumänentums. Entworfen von Paul Langhans. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Size 17 by 21 inches. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafel 35.—Die Umgangssprache der anwesenden Bevölkerung in der Bukowina. Nach den Gemeinde-Ergebnissen der Volkszählung vom 31. Dezember 1910 entworfen von Paul Langhans. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Size 33 by 25 inches. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafel 39. Gotha : Justus Perthes, 1915.

These are all ethnographical and language maps of various parts of Europe immediately concerned in present military operations, accompanying articles and notes in recent numbers of *Petermanns Geogr. Mitteilungen*.

Europe. **Service Géographique de l'Armée, Paris**

Europe 1,000,000° (1 inch to 15·7 stat. miles). Sheet : Petrograd. Size 18 by 13 inches. Paris : Service Géographique de l'Armée, [1915]. *Price* 1.25 *fr.*

A continuation of the 1 : 1,000,000 map of Europe noticed in the *Geographical Journal* for June last. The sheet extends from 56° to 60° N. lat. and from 26° 20′ to 31° 20′ E. long., but by a remarkable oversight the parallels and meridians are not numbered. It is merely an outline, with few names, printed in colours—water blue, roads red, and railways and names black. The railways are in two symbols, but there is no explanation as to their meaning.

Italy. **Istituto Geografico Militare.**

Carta corografica ipsometrica del Regno d'Italia e delle regioni adiacenti. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheet 7 : Milano-Torino. Florence : Istituto Geografico Militare, 1914. *Price* 3*L. each sheet.*

This is a new edition.

Norway. **Norges Geografiske Opmaaling.**

Landgeneralkart over Norge i 1 : 250,000 (1 inch to 3·9 stat. miles). Utgit av Norges Geografiske Opmaaling. Sheet LV. Kristiania. Size 19 by 19 inches. Christiania : Norges Geografiske Opmaaling, 1915. *Price* 1 *kr. each sheet. Presented by the Director of the Norwegian Geographical Survey.*

A continuation of the new general map of Norway showing relief by brown contours, shading, and "spectral" layer colouring as described in the review of the map which appeared in the *Geographical Journal* for November 1914. The result is fairly good, but the system as here followed does not lend itself to such satisfactory treatment as in the more mountainous parts, and there is hardly sufficient contrast between the colour tints. The contours are at 50-metre intervals. The sheet extends from 59° to 60° N. lat. and from 30′ W. to 1° 30′ E. of Christiania, which is therefore placed on its northern limit.

Russia. **Berger-Levrault.**

Russie-Occidentale. Scale 1 : 1,650,000 or 1 inch to 26·04 stat. miles. Size 37 by 25 inches. Nancy : Berger-Levrault, [1915].

A roughly printed map of western Russia, showing railways.

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 164, Morley, Alberta, 7th edit., 1 Jan. 1915 ; 169, Touchwood, Saskatchewan, 7th edit., 1 Dec. 1914 ; 171, Duck Mountain, Manitoba, 7th edit., 1 Jan. 1915 ; 215, Red Deer, Alberta, 9th edit., 1 Jan. 1915 ; 267, Battleford, Saskatchewan, 7th edit., 1 March 1915 ; 268, Carlton, Saskatchewan, 8th edit., 1 March 1915 ; 369, Montreal Lake, Saskatchewan, 1st edit., 1 Nov. 1914 ; 370, Cumberland, Saskatchewan, 1st edit., 1 April 1915 ; 417, Primrose, Saskatchewan, 1st edit., 1 April 1915. Size 17 by 28 inches. Ottawa : Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

Canada—Nova Scotia. **Dept. of Mines, Ottawa.**

Geological Survey of Canada. Map 137A, Arisaig, Antigonish County. Scale 1 : 40,000 or 1·5 inch to 1 stat. mile. Size 8 by 14 inches. Map 138A, Arisaig-Antigonish, Antigonish County. Scale 1 : 126,720 or 2 inches to 1 stat. mile. Size 8 by 6 inches. Ottawa : Department of Mines, Geological Survey, 1915. *Presented by the Department of Mines, Ottawa.*

Canada—Ontario. **Bacon.**

Bacon's Excelsior Map of Ontario. Scale 1 : 850,000 or 1 inch to 13·4 stat. miles. 4 sheets, each 29 by 40 inches. London : G. W. Bacon & Co. Toronto : W. J. Gage & Co., 1915. *Price, in sheets, 21s. Presented by Messrs. G. W. Bacon & Co.*

This is a useful general wall-map of Ontario in four sheets which can be conveniently mounted as one. In addition to counties, which are shown in colours, railways, steamship routes, forest and Indian reserves, Hudson Bay Co.'s ports and canals are indicated. There are, as insets, a general map of Canada and a map on the scale of 1 inch to 47 miles of the whole of Ontario, including the northern extension of the province to Hudson Bay. Another useful addition is the table of distances between places, which is ingeniously arranged for quick reference.

Panama. **Ryde.**

The District of Panama. By Percy W. Ryde. Scale 1 : 150,000 or 1 inch to 2·36 stat. miles. Size 16 by 18 inches. London : G. W. Bacon & Co., Ltd., 1915. *Price 7s. 6d. Presented by the Publishers.*

Two maps, for schools, on one sheet. The first shows the Panama district as it was before the construction of the canal, with height of land on the layer system with contours at 85, 150, 300, 600, and 900 feet ; and the other without layer colouring as it is at the present day, with the canal. The maps are placed side by side, and under each is a sort of bird's-eye view of what is represented on the map above it. There is also a useful note giving particulars of the canal, for the use of the teacher.

Peru and Ecuador. **Sievers.**

Reiseweg in Peru und Ecuador 1909. Von Wilhelm Sievers. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Four sheets. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafeln 20, 24, 25 u. 26. Gotha : Justus Perthes, 1915.

Four maps from Dr. W. Sievers' route surveys made during his travels in northern Peru and Ecuador in 1909. The journeys shown on Sheet I. extend from lat. 8° 30′ to 10° 40′ S. and from long. 76° 30′ to 78° 25′ W., while Sheet II., which joins Sheet I. to the north, shows a single route from near Conchucos north-east and north *vid* the upper waters of the Rio Marañon to Cajamarca, and thence north and west to the Pacific coast at Chiclayo. Sheets III. and IV. show the route from Payta on the coast in lat. 5° S. across the mountains to Loja and thence in a northerly direction to Alausi in lat. 2° 10′ S. It is merely a compass and watch traverse but gives a considerable amount of topographical detail.

AUSTRALASIA.

New Guinea. **Pilhofer and Schmidt.**

Durchquerung von Neuguinea in Hinterlande des Hüon-Golfes. Nach dem Reisetagebuch von Missionar G. Pilhofer konstruiert von C. Schmidt. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Two sheets each 13 by 27 inches. *Petermanns Geogr. Mitteilungen*, Jahrgang 1915, Tafeln 1 u. 10. Gotha : Justus Perthes, 1915.

A map in two sheets showing the journey of the German missionary Herr G. Pilhofer, in German New Guinea, made in August and September 1913 up the Waria river to its source, thence north-west as far as lat. 7° S. and down the Markham River in an

easterly direction to its mouth. The route has been plotted from the traveller's field note-book, and is important since it passes through what was previously to a great extent unexplored country. An account of the journey is given in *Petermanns Mitteilungen* for January and February 1915 (see Monthly Record, *supra*, p. 65).

WORLD.

World. **Johnston.**

The World-Wide Atlas of Modern Geography, Political and Physical, containing one hundred and twenty-eight plates and complete index. With an introduction by J. Scott Keltie, LL.D. 8th edit. Size 12 by 10 inches. Edinburgh and London: W. & A. K. Johnston, Ltd., 1915. *Price 7s. 6d.*

A comparison of this edition with the seventh, which appeared eight years ago, shows that a considerable amount of revision has taken place and several new maps have been added. Dr. Scott Keltie has brought his introduction up to date by including references to the more recent explorations. This introduction is a special feature in the atlas and should be useful for ready reference since it contains a good, though necessarily brief, summary of the most important journeys of explorers with dates, besides notes on other matters of a geographical character. Among the new sheets of maps are No. 1, which now consists of two small maps, one of the North Pole and another of the South, instead of one map of North Polar regions only; 37, a new map of Serbia, Montenegro and Albania; and 38, Greece. The orographical maps of the continents have also been re-drawn from later information, and the layer colouring improved. An addendum giving place-names not previously included appears at the end of the index.

PHOTOGRAPHS.

China—Kansu. **Teichman.**

Thirty-eight photographs of Kansu, taken by Mr. Eric Teichman. 1915. *Presented by Mr. Eric Teichman.* 1915.

These photographs were taken by Mr. Teichman of the British Legation, Peking, during an extensive journey he has made recently in Kansu in connection with his official duties. He had exceptional facilities afforded him for travelling and was accompanied by Chinese officials, so was enabled to visit parts that are little known to Europeans; consequently the photographs are of exceptional interest. Many of them show the character of the country and native types extremely well. They measure 3 by 4 inches.

(1 and 2) Loess country of Central Kansu; (3) T'ao River valley between Lanchou and Hochou, showing loess superimposed on red sandstone; (4) Bird's-eye view of Labrang Monastery, one of the largest and wealthiest of Tibetan Lamaseries; (5 and 6) Interior of Labrang Monastery; (7) Tibetan shrine near Taochou, South Kansu; (8) Tibetan woman near Labrang; (9) Camp provided by Chinese officials in the desert west of Chenfan (North-West Kansu); (10) Peking-Turkestan high-road, at approach to Liupan Pass (9000 feet) in East Kansu; (11) Peking-Turkestan high-road lined with trees in East Kansu; (12) Monastery of Shakoussu, near Labrang; (13) Monastery of Kachiassu, near Labrang; (14) Midday halt in Tibetan farmhouse near Taochou, South Kansu; (15, 16, and 17) Three views of Monastery of Heitsossu, two days south of Labrang; (18, 19 and 20) Kansu Tibetans; (21, 22, and 23) Gorges of the Yellow River between Lanchou and Chungwei; (24, 25, and 26) Rafts on the Yellow River, a few days below Lanchou; (27) Small raft of inflated sheepskins on the Yellow River near Ninghsia; (28) On the Yellow River in the Ordos Desert; (29) Wool cargo-boat on the Yellow River near Paot'ou; (30) View of the Koko Nor grass country (10–11,000 feet) west of Taochou: yak in the foreground and caravan in the background; (31) View of the Koko Nor grass country (10–11,000 feet) west of Taochou: Tibetan tents in background; (32) The Koko Nor steppe near Yungan, four days north of Siring on the Kansu border (10–11,000 feet); (33) Gorge leading south from Kanchou (North-West Kansu) up to the Koko Nor plateau; (34) Gorge leading south from Kanchou (North-West Kansu) up to the Koko Nor plateau: caravan crossing stream in foreground; (35) The Tao River valley, west of Taochou (South Kansu); (36, 37, and 38) Three views on the road to Labrang.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

SPAIN
MEDITERRANEAN SEA
Sicily
Malta (Br.)
Gibraltar
Str. of Gibraltar
ALGERIA
MOROCCO
SOUTH TERRITORY
Gulf of Sidra
Benghazi
Ghadames
TRIPOLI
Canary Islands
Spanish Gt. Canaria
Gran Canaria
RIO DE ORO (SPAIN)
Tropic of Cancer
SAHARA
Adrar
el Juf
Tenduf
Mayara
Marabuti
el Eglab
Tuat
Fezzan
Ghat
Sebha
Fugha
Bilma
Agadem
Bodele
FRENCH WEST AFRICA
Sahel
UPPER SENEGAL AND THE NIGER
SENEGAL
GAMBIA
PORTUGUESE GUINEA
FRENCH GUINEA
Futa Jallon
SIERRA LEONE
LIBERIA
IVORY COAST
ASHANTI
GOLD COAST
Bight of Benin
Bight of Biafra
NIGERIA
CAMEROONS
FRENCH CAMEROONS
SPANISH GUINEA
GABUN
ATLANTIC
Loango
Kabinda (Port.)
ANGO
(PORTUGUESE WEST AF

20
30
40
50
60
30
20
10
0
10
ASIA MINOR
PERSIA
Tehran
Baghdad
Damascus
Beirut
Tripoli
Cyprus (Brit.)
Cyrenaica
Sinai
EGYPT
Libyan Desert
Kufra
Dakhla
Kharga
Baharia
Siwa
Jarabub
Jalo
Sollum
Matruh
W. Natrun
Cairo
Suez
Red Sea
PERSIAN GULF
Gulf of Oman
Bandar Abbas
Muscat
Nubian Desert
Dongola
Abu Hamed
Berber
Khartum
Omdurman
Shendi
Sennar
Singa
Kassala
Port Sudan
Suakin
Ras Kasar
Adarama
Fashoda
Malakal
Meshra er Req
Bahr el Ghazal
Wadai
Darfur
Kordofan
Obeid
Bara
Fasher
Kebkabia
Wau
Rumbek
Yei
Mongalla
Lado
Gondokoro
Rejaf
Juba
Nimule
Gambela
Jimma
Harar
Diredawa
Hargeisa
Berbera
Bulhar
Zeila
Obbia
Socotra
Aden (Br.)
Danakil
Gulf of Aden
ANGLO-EGYPTIAN SUDAN
ABYSSINIA
SOMALILAND PROTECTORATE (Brit.)
ITALIAN SOMALILAND
UGANDA PROTECTORATE (Brit.)
EAST AFRICA PROTECTORATE (Brit.)
GERMAN EAST AFRICA
BELGIAN CONGO
UBANGI-SHARI TERRITORY
FRENCH WEST AFRICA
Lake Rudolf
Lake Stefanie
Lake Albert
Lake Kivu
Victoria Nyanza
Tanganyika
Nyasa
Mombasa
Pemba
Zanzibar
Kilimanjaro
Mt. Elgon
Mt. Ruwenzori
Mt. Kenia
Mt. Meru
Mt. Aberdare
Mt. Kilimanjaro
Mt. Mlanje
Mt. Chiperone
Mt. Gurue
Mt. Namuli
Mt. Milange
Mt. Morrumbala
Mt. Zomba
Mt. Mulanje
Mt. Chiradzulu
Mt. Ruo
Mt. Chiperone
Mt. Gurue
Mt. Namuli
Mt. Milange
Mt. Morrumbala
Mt. Zomba
Mt. Mulanje
Mt. Chiradzulu
Mt. Ruo
Amirante Is. (Br.)
Seychelles (Br.)
Aldabra I. (Br.)
Farquhar Is. (Br.)
Cosmoledo Is. (Br.)
Assumption I. (Fr.)
Astove I. (Br.)
Cargados Carajos Is. (Br.)
Rodriguez I. (Br.)
Mauritius (Br.)
Reunion (Fr.)
INDIAN OCEAN

Map to illustrate the paper on

RAILWAY DEVELOPMENT OF AFRICA

PRESENT AND FUTURE

by

SIR CHARLES METCALFE BART.

Scale 1:20,000,000 or 1 Inch = 315·6 Stat. Miles

100 0 100 200 300 400 500 600

Reference

Railways constructed ———

" proposed and projected - - - - - - -

Heights in feet

Zenithal Equal. area Projection.

Published by the Roya

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RAILWAY DEVELOPMENT
AFRICA
Metcalfe